

**FINAL HAZARD RANKING SYSTEM PACKAGE**

**SUTTON BROOK DISPOSAL AREA  
TEWKSBURY, MASSACHUSETTS  
CERCLIS ID NO.: MAD980520696**

Prepared For:

U.S. Environmental Protection Agency  
New England  
Office of Site Remediation and Restoration  
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## SITE DESCRIPTION

The Sutton Brook Disposal Area (“the site”), which is roughly synonymous with the Rocco’s Disposal Area site, is located off South Street on the eastern boundary of Tewksbury, Middlesex County, Massachusetts (see Figures 1, 2, and 3 in Attachment A of this document) [8; 32, p. 164 of 295]. The site is in excess of 50 acres [7, pp. vi, 50]. A small portion of the site also extends into the Town of Wilmington, Massachusetts [5, pp. 1, 2; 7, p. 50]. The Sutton Brook Disposal Area is bounded by a former railroad grade along the northern boundary, beyond which is a former piggery and a forested area; residential properties to the west; undeveloped woodland and wetlands to the south; and the Tewksbury/Wilmington town line and agricultural land to the east [7, p. 4; 8]. The site comprises three source areas: a 50-acre landfill, an area of buried drums, and contaminated soils associated with the drum disposal area [91, p. 1]. These three source areas are located on what is known as the Rocco’s Disposal Area [91, p. 1]. Several additional drum burial areas and suspected disposal areas have recently been identified in the vicinity of the site and are currently being investigated by the Massachusetts Department of Environmental Protection (MA DEP) [91, p. 1]. As additional information becomes available, the U.S. Environmental Protection Agency (EPA) will determine whether these other source areas should be included in the Sutton Brook Disposal Area site [91, p. 1].

Waste disposal activities at the Sutton Brook Disposal Area can be traced back to at least 1957, when an area of the site was used as a “burning dump” [7, p. 4]. This area was originally designated by the Tewksbury Board of Health as a temporary disposal area (landfill) [7, pp. 4, 5; 12]. In 1961, the temporary assignment was modified to require that the landfill on the site be operated as a sanitary landfill, accepting municipal refuse generated only in the Town of Tewksbury [7, p. 5]. The assignment was not complied with, as the landfill accepted municipal, commercial, and industrial wastes from both inside and outside the town [7, p. 5]. The owners of the landfill received numerous violation citations from state and local officials for violating Massachusetts Sanitary Landfill Regulations [7, p. 5; 13, pp. 1, 2; 14, pp. 1, 2; 15, pp. 1, 2; 16, pp. 1, 2; 17, pp. 1-6; 18, pp. 1, 2].

In 1966, the Town of Tewksbury was ordered by the Commonwealth of Massachusetts (the Commonwealth) Commissioner of Public Health to operate the landfill using the sanitary landfill method [19]. However, after 1966, there were documented occurrences of landfill burning, uncovered waste areas, the filling in of on-site wetlands, wastes disposed below the water table, and landfill slopes that exceeded operation plans [13, pp. 1, 2; 14, pp. 1, 2; 15, pp. 1, 2; 16, pp. 1, 2; 17, pp. 1-6; 18, pp. 1, 2]. Due to these violations, the Commonwealth ordered the closure of the landfill in 1979 [20, pp. 1, 2]. At the time of its closure in 1979, the landfill was accepting in excess of 250 tons of waste per day [7, p. 5]. Despite the closure order, landfill operations continued until 1982, when official landfill operations were suspended, but waste acceptance continued through 1988 [7, p. 5; 21, pp. 1-9].

The area of the landfill is approximately 50 acres [9, p. 2]. The landfill volume is estimated at approximately 1.9 million cubic yards (yd<sup>3</sup>) [7, p. 89, Figure 1.6-1, Appendix E, p. 1 of 10]. During the 1999 EPA New England Superfund Technical Assistance and Response Team (EPA START) on-site reconnaissance, a number of erosional cuts, leachate seeps, and collapsed areas were observed in the cover material of the landfill [3, pp. 4, 5, 11-19]. Sutton Brook (and associated wetlands) flows east to west through the property, dividing the landfill into northern and southern lobes [3, p. 12]. Additional wetland areas are located south of the landfill and along the eastern and western portions of the property [3, pp. 6, 12; 8; 61]. Approximately 300 yards south of the landfill is an unnamed pond, used seasonally for ice skating [11, p. 2 and Attachment 1; 67, p. 2 and Attachment 1].

In 1983, a loam screening business began operation on the property [7, p. 4]. On 11 August 1983, during an inspection by the Massachusetts Department of Environmental Quality Engineering (MA DEQE) (currently MA DEP), underground burning was observed through fissures in the ground in the southern landfill lobe [71, pp. 1, 2]. During a subsequent inspection conducted by MA DEQE personnel on 12 August 1983, flames and smoke were no longer visible after heavy machinery had covered the fissures with soil [71, pp. 1, 2]. Subsequent investigations by Tewksbury Health Inspectors and MA DEQE documented piles of demolition debris and soil on areas of the property, in some cases adjacent to and/or encroaching upon on-site wetland areas [23, pp. 11-13; 24, pp. 1, 2; 25, p. 3].

## **SITE DESCRIPTION (Continued)**

Numerous investigations of the site by local, state, and federal organizations have revealed the presence of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and inorganic elements in on-site and off-site ground water, surface water, sediment, soil, and VOCs and SVOCs in air samples [7, Table 1.3-1].

The following three sources have been identified on the site through investigations conducted by federal and state personnel: landfill, drums, and contaminated soil.

### Landfill

The Landfill (Source 1), located on portions of Lots 15, 33, 34, 35, 69, and 70, was identified at the site based on the Town of Tewksbury Tax Assessor's maps, the Town of Wilmington Tax Assessor's maps, ownership records, and historical information [4, pp. 1-5; 5, pp. 1, 2; 12; 19]. Source 1 comprises an area estimated at 50 acres which was used by the owner from 1957 to 1982 for the disposal of municipal wastes, solvents, sanitary sewage sludge containing unknown amounts of unidentified hazardous substances, paint sludges, and steel drum reconditioning waste [7, p. 5]. An unknown volume of municipal wastes from the Town of Tewksbury were also deposited in the landfill until its closure in 1982 [7, p. 5]. As of December 1980, the Town of Tewksbury was generating approximately 60 tons of municipal refuse per day which was disposed of at the landfill [7, p. 5]. At that same time, numerous unspecified commercial businesses also disposed of over 40 tons of refuse per day at the landfill [7, p. 5]. Dumping of scrap metal, construction debris, asphalt, and petroleum-contaminated sludges reportedly continued on the property through 1988 [7, p. 5].

The following observations were made by EPA START personnel during the 19 March 1999 on-site reconnaissance regarding the condition of Source 1: numerous 55-gallon drum remnants were noted on the surface of and partially buried throughout Source 1; trash material was protruding through the southern slope of the northern lobe; cover material along the eastern slope of the northern lobe of Source 1 is approximately 0.5 to 1 foot thick was not effectively containing landfill material due to erosion; and numerous leachate seeps were noted along the slopes of the northern and southern landfill lobes [3, pp. 4, 5, 11-19]. It was also noted by property representatives at the time of the on-site reconnaissance that the northern lobe of Source 1 has settled or collapsed on itself approximately 10 to 15 feet since initial deposition of landfill material [3, p. 5].

Shallow soil samples were collected by EPA Region I contractors on 26 October 1989 from the landfill and surrounding area. The shallow soil samples from Source 1 were collected to confirm the presence of organic and inorganic hazardous substances in the source [9, p. 10, Table 5, Figure 2]. The soil samples were analyzed for organic compounds and inorganic elements through EPA's Contract Laboratory Program (CLP) [9, p. 10]. The data were validated according to EPA New England Tier II requirements [33, p. 1; 34, p. 1]. VOCs, SVOCs, PCBs, and inorganic elements were detected in Source 1 at concentrations significantly exceeding the background sample concentration (SS-13) [9, pp. 11-12, Table 6]. These results were consistent with analytical results from previous sampling events which also indicated the presence of VOCs, SVOCs, and PCBs [7, Table 1.3-1].

### Drum Disposal Area

The drum disposal area (Source 2) located at the site, was identified based on historical information, geophysical surveys, test-pitting operations, and interpretation of other on-going investigations [4, pp. 1-5; 7, p. 5; 31, pp. 01-14; 83, pp. 1-12].

Source 2 is located west of Source 1 and occupies a portion of Lot 35 on the Town of Tewksbury Tax Assessor's Map Nos. 108 and 109 [4, pp. 1-5]. MA DEP received confidential information in Spring 1999 from "a reliable source" about drums having been buried at the landfill in the early 1980s [31, p. 02].

## **SITE DESCRIPTION (Concluded)**

In June 1999, MA DEP personnel conducted a magnetic survey in the area which was reported to contain buried drums [31, p. 05]. MA DEP conducted test-pitting operations in areas identified by the magnetic survey [31, p. 05]. During test-pitting operations, approximately 60 55-gallon drums were discovered in one location [31, pp. 02, 05, 06; 56, pp. 1-1, 4-2]. The drums were not intact after years of being buried (or being crushed when buried), and most of the contents of the drums had leaked into the soil and ground water in the area of Source 2 [31, p. 02; 56, p. 4-2]. MA DEP noted that some of the drums discovered contained a “sludge material” [31, p. 05]. A source sample of the sludge material in one of the drums was collected (sample D40) and submitted to a private laboratory for VOC analysis by standard EPA methods [31, p. 05; 56, p. 4-3]. Analytical results of the drum sludge sample indicated the presence of three VOCs [31, pp. 06, 10; 108, pp. 1, 2].

MA DEP conducted baseline air monitoring in the area of Source 2 before conducting test-pitting activities [31, p. 03]. Prior to excavation, air quality monitoring did not indicate a release to the air from Source 2 [31, p. 03]. However, elevated readings on field air monitoring instrumentation were noted in ambient air as drums were uncovered [31, p. 03; 87, p. 2]. After drum sludge samples were collected from the excavation, the area was backfilled and the air quality returned to background conditions [31, p. 03; 87, p. 2].

As a result of the identification of drums, EPA START personnel conducted a magnetic and electromagnetic survey in an area surrounding Source 2 on 3 June 1999 [31, p. 05; 39, pp. 1-3]. Several anomalies indicating possible additional drum disposal locations were identified as a result of the EPA START geophysical survey; however, no drums were discovered in these areas during subsequent excavation activities [31, p. 05; 39, p. 3].

### Drum Disposal Area Soils

Contaminated soil (Source 3) has been identified at the site in the same location as Source 2. The presence of Source 3 is a direct result of the poor containment of Source 2 [31, p. 03]. Source 3 was identified at the site based on historical information, test-pitting operations, and subsurface soil sampling [7, p. 5; 31, pp. 02-06; 56, p. 1-1; 83, pp. 1-12; 109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6].

Source 3 is an area of contaminated soil located to the west of Source 1 which occupies a portion of Lot 35 on the Town of Tewksbury Tax Assessor’s Map Nos. 108 and 109 [4, pp. 1-5]. MA DEP received confidential information in Spring 1999 from “a reliable source” about drums having been buried at the landfill in the early 1980s [31, p. 02].

In conjunction with the discovery of Source 2 by MA DEP personnel, subsurface soil samples were collected from the drum disposal area via a direct-push device by EPA START personnel from 26 July 1999 through 10 August 1999 to determine extent and depth of contamination [83, pp. 2-11]. Based on the results of on-site soil screening, utilizing a Photovac 10A10 photoionization detector, EPA START personnel collected confirmatory soil samples from Source 3 [35, pp. 4, 5; 83, pp. 2-12, Appendix N (Table G)]. The confirmatory soil samples were collected at depths of 2 to 14 feet below ground surface [83, p. 2, Appendix N (Table G)]. The soil samples were submitted to an EPA laboratory for VOC analysis by standard EPA methods [109, Attachment A, p. 1; 110, Attachment A, p. 1; 111, Attachment A, p. 1; 112, Attachment A, p. 1]. An EPA New England Tier II validation was performed on the confirmatory soil sample analytical results [109, p. 1; 110, p. 1; 111, p. 1; 112, p. 1]. Validated analytical results of subsurface soil samples collected indicated the presence of ethylbenzene, toluene, and xylenes (total) in the soil samples [109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6].

## **HRS DOCUMENTATION RECORD--REVIEW COVER SHEET**

Name of Site: Sutton Brook Disposal Area

### Contact Persons

Site Investigation:

Roy F. Weston, Inc. (WESTON®)/ (781) 229-6430  
Superfund Technical Assessment and  
Response Team (START)  
(Mr. Sean P. Kennedy, Mr. Joseph Schmidl, and Ms. Denise Nelson)

Documentation Record:

EPA New England (617) 918-1436  
(Ms. Nancy Smith)

### Pathways, Components, or Threats Not Scored

After reviewing all pathways, it was determined that the soil exposure and air migration pathway scores would not contribute significantly to the overall site score at this time. Therefore, those pathways have not been included in this HRS package.

## HRS DOCUMENTATION RECORD

Name of Site: Sutton Brook Disposal Area

EPA Region: EPA New England

Date Prepared: 19 July 2000

Street Address of Site: Off of South Street, Tewksbury

County and State: Middlesex County, Massachusetts

General Location in the State: Northeast portion of the State

Topographic Map: Reading, Mass. U.S. Geological Survey. 1987 (see Figure 2 in Attachment A of this document).

Latitude: N 42° 35' 53.6"

Longitude: W 71° 10' 59.5"

[8; 22; 32, p. 164 of 295]

### Scores

Ground Water Pathway	55.25
Surface Water Pathway	100.00
Soil Exposure Pathway	Not Scored
Air Pathway	Not Scored

### **HRS SITE SCORE**

**57.12**

### WORKSHEET FOR COMPUTING HRS SITE SCORE

	S	S <sup>2</sup>
1. Ground Water Migration Pathway Score (S <sub>gw</sub> ) (from Table 3-1, line 13)	55.25	3,052.56
2a. Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	100.00	10,000.00
2b. Ground Water to Surface Water Migration Component	NS	NS
2c. Surface Water Migration Pathway Score (S <sub>sw</sub> ) Enter the larger of lines 2a and 2b as the pathway score.	100.00	10,000.00
3. Soil Exposure Pathway Score (S <sub>s</sub> ) (from Table 5-1, line 22)	NS	NS
4. Air Migration Pathway Score (S <sub>a</sub> )	NS	NS
5. Total of S <sub>gw</sub> <sup>2</sup> + S <sub>sw</sub> <sup>2</sup> + S <sub>s</sub> <sup>2</sup> + S <sub>a</sub> <sup>2</sup>	13,052.56	
6. <b>HRS Site Score</b> Divide the value on line 5 by 4 and take the square root	<b>57.12</b>	

NS = Not scored.

**TABLE 3-1**  
**GROUNDWATER MIGRATION COMPONENT SCORESHEET**

<u>Factor Categories and Factors</u>		<u>Maximum Value</u>	<u>Value Assigned</u>
<u>Likelihood of Release to an Aquifer</u>			
1.	Observed Release	550	550
2.	Potential to Release		
2a.	Containment	10	NS
2b.	Net Precipitation	10	NS
2c.	Depth to Aquifer	5	NS
2d.	Travel Time	35	NS
2e.	Potential to Release (lines 2a × [2b + 2c + 2d])	500	NS
3.	Likelihood of Release (greater of lines 1 and 3)	550	<u>550</u>
<u>Waste Characteristics</u>			
4.	Toxicity/Mobility	a	10,000
5.	Hazardous Waste Quantity	a	100
6.	Waste Characteristics Factor Category Value	100	<u>32</u>
<u>Targets</u>			
7.	Nearest Well	50	20
8.	Population		
8a.	Level I Concentrations	b	0
8b.	Level II Concentrations	b	0
8c.	Potential Contamination	b	229
8d.	Population (lines 8a + 8b + 8c)	b	229
9.	Resources	5	5
10.	Wellhead Protection Area	20	5
11.	Targets (lines 7 + 8d + 9 + 10)	b	<u>259</u>
<u>Ground Water Migration Score for an Aquifer</u>			
12.	Aquifer Score $([lines\ 3 \times 6 \times 11] \div 82,500)^c$	100	<u>55.25</u>
<u>Ground Water Migration Component Score</u>			
13.	Ground Water Pathway Score ( $S_{gw}$ ), (highest value from line 12 for all aquifers evaluated)	100	<u>55.25</u>

<sup>a</sup>Maximum value applies to Waste Characteristics Category.

<sup>b</sup>Maximum value not applicable.

<sup>c</sup>Do not round to the nearest integer.

NS = Not scored.

**TABLE 4-1**  
**SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET**

<u>Factor Categories and Factors</u>		<u>Maximum Value</u>	<u>Value Assigned</u>
<b>DRINKING WATER THREAT</b>			
<u>Likelihood of Release</u>			
1.	Observed Release	550	550
2.	Potential to Release by Overland Flow		
2a.	Containment (Overland Flow)	10	NS
2b.	Runoff	25	NS
2c.	Distance to Surface Water	25	NS
2d.	Potential to Release by Overland Flow (lines 2a × [2b + 2c])	500	NS
3.	Potential to Release by Flood		
3a.	Containment (Flood)	10	NS
3b.	Flood Frequency	50	NS
3c.	Potential to Release by Flood (lines 3a × 3b)	500	NS
4.	Potential to Release (lines 2d + 3c, subject to a maximum value of 500)	500	NS
5.	Likelihood of Release (greater of lines 1 and 4)	550	550
<u>Waste Characteristics</u>			
6.	Toxicity/Persistence	a	NS
7.	Hazardous Waste Quantity	a	NS
8.	Waste Characteristics Factor Category Value	100	NS
<u>Targets</u>			
9.	Nearest Intake	50	0
10.	Population		
10a.	Level I Concentrations	b	0
10b.	Level II Concentrations	b	0
10c.	Potential Contamination	b	0
10d.	Population (lines 10a + 10b + 10c)	b	0
11.	Resources	5	0
12.	Targets (lines 9 + 10d + 11)	b	<u>0</u>
<u>Drinking Water Threat Score</u>			
13.	Drinking Water Threat Score ([lines 5 × 8 × 12] ÷ 82,500)	100	<u>0</u>

NS = Not scored.

**TABLE 4-1**  
**SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET (Continued)**

<u>Factor Categories and Factors</u>	<u>Maximum Value</u>	<u>Value Assigned</u>
<b>HUMAN FOOD CHAIN THREAT</b>		
<u>Likelihood of Release</u>		
14. Likelihood of Release (same value as line 5)	550	<u>550</u>
<u>Waste Characteristics</u>		
15. Toxicity/Persistence/Bioaccumulation	a	5×10 <sup>8</sup>
16. Hazardous Waste Quantity	a	100
17. Waste Characteristics Factor Category Value	1,000	<u>320</u>
<u>Targets</u>		
18. Food Chain Individual	50	20
19. Population		
19a. Level I Concentrations	b	NS
19b. Level II Concentrations	b	NS
19c. Potential Human Food Chain Contamination	b	0.003033
19d. Population (lines 19a + 19b + 19c)	b	0.003033
20. Targets (lines 18 + 19d)	b	<u>20.003033</u>
<u>Human Food Chain Threat Score</u>		
21. Human Food Chain Threat Score ([lines 14 × 17 × 20] ÷ 82,500)	100	<u>42.67</u>

NS = Not scored.

**TABLE 4-1**  
**SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET (Concluded)**

<u>Factor Categories and Factors</u>	<u>Maximum Value</u>	<u>Value Assigned</u>
<b>ENVIRONMENTAL THREAT</b>		
<u>Likelihood of Release</u>		
22. Likelihood of Release (same value as line 5)	550	<u>550</u>
<u>Waste Characteristics</u>		
23. Ecosystem Toxicity/Persistence/Bioaccumulation	a	5×10 <sup>8</sup>
24. Hazardous Waste Quantity	a	100
25. Waste Characteristics Factor Category Value	1,000	<u>320</u>
<u>Targets</u>		
26. Sensitive Environments		
26a. Level I Concentrations	b	NS
26b. Level II Concentrations	b	55
26c. Potential Contamination	b	5
26d. Sensitive Environments (lines 26a + 26b + 26c)	b	60
27. Targets (value from line 26d)	b	<u>60</u>
<u>Environmental Threat Score</u>		
28. Environmental Threat Score ([lines 22 × 25 × 27] ÷ 82,500)	60	<u>60</u>
<b>SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE FOR A WATERSHED</b>		
29. Watershed Score <sup>c</sup> (lines 13 + 21 + 28)	100	<u>100</u>
<b>SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE</b>		
30. Component Score (S <sub>of</sub> ) <sup>c</sup> (highest score from line 29 for all watersheds evaluated, subject to a maximum value of 100)	100	<u>100</u>

<sup>a</sup>Maximum value applies to Waste Characteristics Category.

<sup>b</sup>Maximum value not applicable.

<sup>c</sup>Do not round to the nearest integer.

## NOTES TO THE READER

All reference citations used to document the HRS score will follow the following conventions:

Reference 42	= Reference No. 42 (all references cited by number)
Attachment A	= Attachment A
Appendix A	= Appendix A
Figure 1	= Figure 1
Table 1	= Table 1
p.	= single page
pp.	= multiple pages (pp. 2-5, 9 or pp. A-1 to A-10)
","	= next reference

For example:

"Source No. 1 is located in the southern portion of the site at a topographic high [4, Plate 3; 5, pp. 15-21, 23]," means that the information presented is documented in Reference No. 4 on Plate 3 and Reference No. 5 on pages 15 through 21 and page 23.

Referenced text has been either quoted or paraphrased for clarity.

The following additional notations have been used throughout the package:

NS	= Not Scored.
NE	= Not Evaluated.
ND	= Not Detected.
mg/kg	= milligrams per kilogram.
$\mu\text{g/kg}$	= micrograms per kilogram.
mg/L	= milligrams per liter.
$\mu\text{g/L}$	= micrograms per liter.

The hazardous substance benzo(a)anthracene is identified in the Superfund Chemical Data Matrix (Reference 2) as "benz(a)anthracene." For clarity, benzo(a)anthracene is used as the spelling for this hazardous substance throughout this package, regardless of the reference.

## REFERENCES

(see attached volumes)

### Reference

<u>Number</u>	<u>Description of the Reference</u>
1.	U.S. Environmental Protection Agency. Hazard Ranking System, 40 CFR Part 300, 55 FR 51583. 14 December 1990. 135 pages.
2.	U.S. Environmental Protection Agency. Superfund Chemical Data Matrix (SCDM). June 1996. 987 pages.
3.	Roy F. Weston, Inc. Superfund Technical Assessment and Response Team. Field Logbook for Rocco's Disposal Area Tewksbury, MA., No. 00381-S. TDD No. 99-01-0013. Issued 1999. 148 pages.
4.	Nelson, D.M. (START). Project Note, Property Ownership Information and Identification, Tewksbury, Massachusetts. 10 May 2000. 5 pages.
5.	Nelson, D.M. (START). Project Note, Property Ownership Information and Identification. Wilmington, Massachusetts. 10 May 2000. 2 pages.
6.	Schmidl, J., P.G. (START). Telephone Conversation Record with Mr. James Doone (Massachusetts Department of Environmental Protection, Division of Water Supply), RE: Massachusetts Zone II Wellhead Protection Area. TDD No. 00-05-0001. 11 July 2000. 1 page.
7.	Metcalf & Eddy, Inc. <u>Rocco Landfill Initial Site Assessment</u> . June 1996. 105 pages, plus Attachments.
8.	U.S. Geological Survey. Reading, Massachusetts 7.5×15-minute series topographic map. Scale 1:25,000. 1987. Map No. 42071-E1-TM-025. 1 sheet.
9.	NUS Corporation/Field Investigation Team. <u>Final Screening Site Inspection, Rocco's Disposal Area, Tewksbury, Massachusetts</u> . TDD No. F1-8804-07. 15 August 1991. 17 pages plus Attachments.
10.	Reserved.
11.	Susten, A.S., Ph.D. (Agency for Toxic Substances and Disease Registry - ATSDR). 1992. Memorandum to Ms. Louise House (ATSDR Region I Representative), RE: Health Consultation: Rocco's Landfill Site (A106), Middlesex County, Tewksbury, Massachusetts. 25 March 1992. 9 pages.
12.	Abbott, T.A. (Tewksbury Board of Health Chairman). Tewksbury Board of Health Meeting Minutes. 6 August 1957. 1 page.
13.	Tarbell, K.A. (Massachusetts Department of Environmental Quality and Engineering - MA DEQE Regional Sanitary Engineer). Citation to Mr. Anthony Rocco, RE: Tewksbury - Solid Waste Violation of Regulations. 26 September 1972. 2 pages.
14.	Tarbell, K.A. (MA DEQE Regional Sanitary Engineer). Citation to Mr. Anthony Rocco, RE: Tewksbury - Solid Waste Violation of Regulations. 26 March 1973. 2 pages.
15.	Bicknell, W.J. (Massachusetts Department of Public Health - MA DPH). Order to the Tewksbury Board of Health and Mr. Anthony Rocco, RE: Tewksbury - Solid Wastes - An Order to comply with the provisions of Section 150A of Chapter 111 of the General Laws - Disposal Facility off South Street. 11 July 1974. 2 pages.

## REFERENCES (Continued)

16. McMenimen, W.R. (Tewksbury Director of Public Health). Letter to Mrs. Jeanette Rocco, RE: Landfill Violations Noted 24 May 1977. 6 June 1977. 2 pages.
17. McMenimen, W.R. (Tewksbury Director of Public Health). Letter to Mrs. Jeanette Rocco, RE: Landfill Violations Noted 6 July 1977. 13 July 1977. 6 pages.
18. McMenimen, W.R. (Tewksbury Director of Public Health). Letter to Mrs. Jeanette Rocco, RE: Landfill Violations Noted. 9 September 1977. 2 pages.
19. Long, C.W. (Commonwealth of Massachusetts Assistant Attorney General). Letter to Dr. Alfred L. Frechette (Commonwealth of Massachusetts Commissioner of Public Health) , RE: Affirmation of Decree of Superior Court Case of Commonwealth of Massachusetts Commissioner of Public Health vs. Tewksbury Board of Health and Tewksbury Board of Selectman. 11 April 1966. 1 page.
20. Town of Tewksbury Board of Health. Letter to Ms. Jeanette Rocco, RE: Revocation of Assignment of Sanitary Landfill off South Street. 4 December 1979. 2 pages.
21. Rocco, J. (Applicant) Wetlands Protection Act - Notice of Intent. 10 November 1982. 9 pages.
22. Sklaney, C. (START). Project Note, Rocco's Disposal HRS/NPL File, RE: Rocco's Disposal Property Coordinate Calculations. TDD No. 99-11-0008. 10 April 2000. 1 page.
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## SOURCE DESCRIPTION

### 2.2 Source Characterization

Number of the source: 1

Name and description of the source: Landfill (Landfill)

Source 1 comprises an area estimated at 50 acres which was used from 1957 to 1982 for the disposal of municipal wastes, solvents, sanitary sewage sludge containing unknown amounts of unidentified hazardous substances, paint sludges, and steel drum reconditioning waste [7, p. 5]. An unknown volume of municipal wastes from the Town of Tewksbury were also deposited in the landfill until its closure in 1982 [7, p. 5]. As of December 1980, the Town of Tewksbury was generating approximately 60 tons of municipal refuse per day which was disposed of at the landfill [7, p. 5]. At that same time, numerous unspecified commercial businesses also disposed of over 40 tons of refuse per day at the landfill [7, p. 5]. Dumping of scrap metal, construction debris, asphalt, and petroleum-contaminated sludges reportedly continued on the property through 1988 [7, p. 5].

The following observations were made by EPA START personnel during the 19 March 1999 on-site reconnaissance regarding the condition of the Source 1: numerous 55-gallon drum remnants were noted on the surface of and partially buried throughout Source 1; trash material was protruding through the southern slope of the northern lobe; cover material along the eastern slope of the northern lobe of Source 1 is approximately 0.5 to 1 foot thick and was not effectively containing landfill material due to erosion; and numerous leachate seeps were noted along the slopes of the northern and southern lobes of Source 1 [3, pp. 4, 5, 11-19]. It was also noted by property representatives at the time of the on-site reconnaissance that the northern lobe of Source 1 has settled or collapsed on itself approximately 10 to 15 feet since initial deposition of landfill material [3, p. 5].

The volume of Source 1 was estimated at 1.9 million yd<sup>3</sup> [7, p. 89, Appendix E, p. 1 of 10]. This value was derived by measuring the area of topographic contour lines within the identified waste limits of the 1995 topographic base plan and assuming a constant base elevation as being the average elevation of the limit of waste [7, p. 89, Figure 1.6-1, Appendix E, p. 1 of 10].

Location of the source, with reference to a map of the site:

Source 1 at the site occupies a large portion of Lots 33, 34 and 35 on the Town of Tewksbury Tax Assessor's Map No. 108 and Lots 69 and 70 on Map No. 109 [4; 7, p. vi; 8]. Source 1 also extends onto small portions of Lot 15 on the Town of Wilmington Tax Assessor's Map No. R-2 and Lot 34 on the Town of Tewksbury Tax Assessor's Map No. 114 [4, pp. 1-5; 5, pp. 1, 2; 8].

### Containment

#### Release to ground water:

Based on historic and EPA START on-site observations, Source 1 shows no evidence of a maintained, engineered cover or a functioning and maintained run-on control or runoff control management system [3, pp. 4, 5, 8, 11-19; 7, pp. vii, 4]. During previous investigations of Source 1, no form of containment structures were encountered that would be representative of a liner, and no leachate collection and removal system is in place [7, pp. vii, 4]. During the on-site reconnaissance, EPA START observed eroded areas on the ground surface on the northern portion and leachate seeps along the southern and eastern slopes of both the northern and southern portions of Source 1 [3, pp. 4, 5, 10, 11, 15]. Evidence of hazardous substance migration from Source 1 has been established [1, p. 51596, Table 3-2; 33, pp. 16-18; 34, pp. 10-13; 98, pp. 7-9; 100, pp. 5, 6; 101, pp. 9, 14, 16; 102, pp. 6, 10, 12; 103, pp. 5-8, 10, 12]. Based on these characteristics, Source 1 is assigned a Containment Factor of 10 [1, pp. 51596, Table 3-2].

#### Release via overland migration and/or flood:

Based on historical and EPA START on-site observations, Source 1 shows no evidence of a maintained, engineered cover or a functioning and maintained run-on control or runoff control management system [3, pp. 4, 5, 8, 11; 7, pp. vii, 4]. During previous investigations of Source 1, no form of containment structures were encountered that would be representative of a liner and no leachate collection and removal system is in place [7, pp. vii, 4]. Evidence of hazardous substance migration from Source 1 to surface water has been established [1, p. 51609, Table 4-2; 33, pp. 16-18; 34, pp. 10-13; 78, pp. 8-9; 79, p. 8; 113, pp. 7, 10, 11; 114, pp. 7, 10]. Based on these characteristics, Source 1 is assigned a Containment Factor of 10 [1, pp. 51609, 51610, Table 4-2].

#### 2.4.1 Hazardous Substances

On 26 October 1989, EPA contractors collected shallow soil samples from Source 1, as well as two background shallow soil samples, a duplicate, and a soil blank [9, p. 10, Table 5, Figure 2]. The shallow soil samples were collected at depths of 0 to 18 inches below ground surface [9, Table 5]. The shallow soil samples were analyzed for Superfund List organic compounds and inorganic elements through EPA CLP [9, p. 10]. The equivalent of an EPA New England Tier II validation was performed on the data [33, p. 1; 34, p. 1]. Seven of the shallow soil samples collected from Source 1 contained one or more hazardous substances at three times or greater than the highest background concentration of the same hazardous substance in the background samples (shallow soil samples SS-12 and SS-13); or if the hazardous substance was not detected in the background samples, greater than or equal to the background samples' highest sample quantitation limit (SQL) (for organic compounds) or sample detection limit (SDL) (for inorganic elements) for that hazardous substance [1, pp. 51588, Section 2.2.3, 51589, Table 2-3; 33, pp. 7- 9, 13-18; 34, pp. 7-14].

Hazardous Substance	Evidence	Reference
Barium	Analytical Evidence	34, pp. 7-14
Benzo(a)anthracene	Analytical Evidence	33, pp. 13-18
Benzo(a)pyrene	Analytical Evidence	33, pp. 13-18
Benzo(g,h,i)perylene	Analytical Evidence	33, pp. 13-18
Chromium	Analytical Evidence	34, pp. 7-14
Chrysene	Analytical Evidence	33, pp. 13-18
Copper	Analytical Evidence	34, pp. 7-14
Ethylbenzene	Analytical Evidence	33, pp. 7-9, 16-18
Fluoranthene	Analytical Evidence	33, pp. 13-18
Indeno(1,2,3-cd)pyrene	Analytical Evidence	33, pp. 13-18
Lead	Analytical Evidence	34, pp. 7-14
Manganese	Analytical Evidence	34, pp. 7-14
Naphthalene	Historical information, Analytical Evidence	7, p. 5; 26, p. 17; 33, pp. 13-18
Nickel	Analytical Evidence	34, pp. 7-14
Vanadium	Analytical Evidence	34, pp. 7-14
Xylenes (total)	Analytical Evidence	33, pp. 7- 9, 16-18
Zinc	Analytical Evidence	34, pp. 7-14

### Background Sample

EPA contractors collected shallow soil samples from Source 1, as well as two background shallow soil samples on 26 October 1989 [9, p. 10, Table 5, Figure 2]. The shallow soil samples were analyzed for Superfund List organic compounds and inorganic elements through EPA's CLP [9, p. 10]. The equivalent of an EPA New England Tier II validation was performed on the data [33, p. 1; 34, p. 1]. Shallow soil samples SS-12 and SS-13 were selected to characterize the background concentrations of the hazardous substances in the medium of concern for the environmental setting on and near the site. Background levels do not necessarily reflect pre-release conditions, nor conditions in the absence of influence from Source 1 [33, pp. 9, 15, 16; 34, pp. 8, 10, 11]. The two background shallow soil samples and the seven shallow soil samples used to establish observed contamination within Source 1 were all collected at a depth of less than 2 feet [9, Table 5].

Sample ID	Depth	Date	Reference
SS-12	0 to 8 inches	26 October 1989	9, Table 5, Figure 2
SS-13	0 to 18 inches	26 October 1989	9, Table 5, Figure 2

For the purposes of this package, shallow soil sample concentrations that are three times or greater than the highest background sample concentration or are greater than or equal to the highest background samples' SQLs or SDLs (if the hazardous substance was not detected in the background sample) are used to associate hazardous substances with Source 1 [1, pp. 51588, Section 2.2.3, 51589, Table 2-3].

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit or Sample Detection Limit	Reference
SS-12	Barium	ND	45.2 mg/kg	34, pp. 8, 10
	Benzo(a)anthracene	ND	390 µg/kg	33, pp. 15, 16
	Benzo(a)pyrene	ND	390 µg/kg	33, pp. 15, 16
	Benzo(g,h,i)perylene	ND	390 µg/kg	33, pp. 15, 16
	Chromium	7.0 mg/kg	2.3 mg/kg	34, pp. 8, 10
	Chrysene	ND	390 µg/kg	33, pp. 15, 16
	Copper	ND	5.7 mg/kg	34, pp. 8, 10
	Ethylbenzene	ND	19 µg/kg	33, pp. 9, 16
	Fluoranthene	ND	390 µg/kg	33, pp. 15, 16
	Indeno(1,2,3-cd)pyrene	ND	390 µg/kg	33, pp. 15, 16
	Lead	8.1 mg/kg	0.68 mg/kg	34, pp. 8, 10
	Manganese	89.1 mg/kg	3.4 mg/kg	34, pp. 8, 10
	Naphthalene	ND	390 µg/kg	33, pp. 15, 16
	Nickel	ND	9.0 mg/kg	34, pp. 8, 10

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit or Sample Detection Limit	Reference
SS-12 (Concluded)	Vanadium	ND	11.3 mg/kg	34, pp. 8, 10
	Xylenes (total)	ND	19 µg/kg	33, pp. 9, 16
	Zinc*	ND	17 mg/kg	34, pp. 8, 10
SS-13	Barium	ND	48.3 mg/kg	34, pp. 8, 11
	Benzo(a)anthracene	ND	400 µg/kg	33, pp. 15, 16
	Benzo(a)pyrene*	ND	4,000 µg/kg	33, pp. 15, 16
	Benzo(g,h,i)perylene*	ND	4,000 µg/kg	33, pp. 15, 16
	Chromium	8.0 mg/kg	2.4 mg/kg	34, pp. 8, 11
	Chrysene	ND	400 µg/kg	33, pp. 15, 16
	Copper	ND	6.0 mg/kg	34, pp. 8, 11
	Ethylbenzene	ND	19 µg/kg	33, pp. 9, 16
	Fluoranthene	ND	400 µg/kg	33, pp. 15, 16
	Indeno(1,2,3-cd)pyrene*	ND	4,000 µg/kg	33, pp. 15, 16
	Lead	1.4 mg/kg	0.72 mg/kg	34, pp. 8, 11
	Manganese	45.9 mg/kg	3.6 mg/kg	34, pp. 8, 11
	Naphthalene	ND	400 µg/kg	33, pp. 15, 16
	Nickel	ND	9.7 mg/kg	34, pp. 8, 11
	Vanadium	ND	12.1 mg/kg	34, pp. 8, 11
	Xylenes (total)	ND	19 µg/kg	33, pp. 9, 16
	Zinc*	ND	15.4 mg/kg	34, pp. 8, 11

\* = Value for substance has been adjusted due to estimated value reported during validation (see listed reference for additional details)

#### Contaminated Samples

On 26 October 1989, EPA contractors collected shallow soil samples from Source 1, as well as two background shallow soil samples [9, p. 10, Table 5, Figure 2]. The shallow soil samples were collected at depths between 0 and 18 inches below ground surface [9, Table 5]. The shallow soil samples were analyzed for Superfund List organic compounds and inorganic elements through EPA CLP [9, p. 10]. The equivalent of an EPA New England Tier II validation was performed on the data [33, p. 1; 34, p. 1]. Seven of the shallow soil samples (SS-02, SS-04, SS-05, SS-06, SS-09, SS-10, and SS-10R) will be used to associate hazardous substances with Source 1 [33, pp. 7, 8, 13, 14, 17, 18; 34, pp. 8, 10, 11]. For the purposes of this package, shallow soil sample concentrations that are three times or greater than the highest background sample concentrations or are greater than or equal to the background samples' highest SQLs or SDLs (if the hazardous substance was not detected in the background samples) are used to associate hazardous substances with Source 1 [1, pp. 51588, Section 2.2.3, 51589, Table 2-3].

Contaminated Samples (Continued)

Sample ID	Depth	Date	Reference
SS-02	0 to 8 inches	26 October 1989	9, p. 10, Table 5
SS-04	0 to 8 inches	26 October 1989	9, p. 10, Table 5
SS-05	0 to 10 inches	26 October 1989	9, p. 10, Table 5
SS-06	0 to 5 inches	26 October 1989	9, p. 10, Table 5
SS-09	0 to 2 inches	26 October 1989	9, p. 10, Table 5
SS-10	0 to 4 inches	26 October 1989	9, p. 10, Table 5
SS-10R	0 to 4 inches	26 October 1989	9, p. 10, Table 5

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit or Sample Detection Limit	Background Sample Concentration	Reference
SS-02	Chromium	26.3 mg/kg	2.9 mg/kg	8.0 mg/kg	34, pp. 4, 5, 7, 8, 10-12
	Copper*	19.6 mg/kg	7.2 mg/kg	ND (6.0 mg/kg)	34, pp. 4, 7, 8, 10-12
	Fluoranthene	780 µg/kg	480 µg/kg	ND (400 µg/kg)	33, pp. 13, 15-17
	Lead	34.9 mg/kg	0.87 mg/kg	8.1 mg/kg	34, pp. 4, 5, 7, 8, 10-12
	Manganese	458 mg/kg	4.3 mg/kg	89.1 mg/kg	34, pp. 4, 5, 7, 8, 10-12
	Vanadium	28.4 mg/kg	14.4 mg/kg	ND (12.1 mg/kg)	34, pp. 4, 5, 7, 8, 10-12
	Zinc	76.6 mg/kg	5.8 mg/kg	ND (17 mg/kg)	34, pp. 4, 5, 7, 8, 10-12
SS-04	Chromium	785 mg/kg	2.6 mg/kg	8.0 mg/kg	34, pp. 4, 5, 7, 8, 10-12
	Copper*	22.9 mg/kg	6.4 mg/kg	ND (6.0 mg/kg)	34, pp. 4, 5, 7, 8, 10-12
	Lead	37.9 mg/kg	0.77 mg/kg	8.1 mg/kg	34, pp. 4, 5, 7, 8, 10-12
	Xylenes (total)	140 µg/kg	21 µg/kg	ND (19 µg/kg)	33, pp. 7, 9, 16, 17
	Zinc	129 mg/kg	5.1 mg/kg	ND (17 mg/kg)	34, pp. 4, 5, 7, 8, 10-12
SS-05	Copper*	7.4 mg/kg	5.7 mg/kg	ND (6.0 mg/kg)	34, pp. 4, 5, 7, 8, 10-13
	Nickel	10 mg/kg	9.1 mg/kg	ND (9.7 mg/kg)	34, pp. 4, 5, 7, 8, 10-13
	Zinc	24.5 mg/kg	4.6 mg/kg	ND (15.4 mg/kg)	34, pp. 4, 5, 7, 8, 10-13

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit or Sample Detection Limit	Background Sample Concentration	Reference
SS-06	Copper*	29.3 mg/kg	5.7 mg/kg	ND (6.0 mg/kg)	34, pp. 4, 5, 7, 8, 10-13
	Lead	371 mg/kg	0.68 mg/kg	8.1 mg/kg	34, pp. 4, 5, 7, 10-13
	Zinc	44 mg/kg	4.5 mg/kg	ND (17 mg/kg)	34, pp. 4, 5, 7, 8, 10-13
SS-09	Barium	167 mg/kg	53.3 mg/kg	ND (48.3 mg/kg)	34, pp. 8, 10, 11, 13
	Benzo(a)anthracene	10,000 µg/kg	4,200 µg/kg	ND (400 µg/kg)	33, pp. 14-17
	Benzo(a)pyrene	9,500 µg/kg	4,200 µg/kg	ND (4,000 µg/kg)	33, pp. 14-17
	Benzo(g,h,i)perylene	4,700 µg/kg	4,200 µg/kg	ND (4,000 µg/kg)	33, pp. 14-17
	Chromium	25.4 mg/kg	2.7 mg/kg	8.0 mg/kg	34, pp. 8, 10, 11, 13
	Chrysene	11,000 µg/kg	4,200 µg/kg	ND (400 µg/kg)	33, pp. 14-17
	Copper*	48.3 mg/kg	6.7 mg/kg	ND (6.0 mg/kg)	34, pp. 8, 10, 11, 13
	Ethylbenzene	450 µg/kg	67 µg/kg	ND (19 µg/kg)	33, pp. 8, 9, 16, 17
	Fluoranthene	24,000 µg/kg	4,200 µg/kg	ND (400 µg/kg)	33, pp. 14-17
	Indeno(1,2,3-cd)pyrene	5,200 µg/kg	4,200 µg/kg	ND (4,000 µg/kg)	33, pp. 14-17
	Lead	325 mg/kg	0.8 mg/kg	8.1 mg/kg	34, pp. 8, 10, 11, 13
	Manganese	305 mg/kg	4.0 mg/kg	89.1 mg/kg	34, pp. 8, 10, 11, 13
	Nickel	59.6 mg/kg	10.7 mg/kg	ND (9.7 mg/kg)	34, pp. 8, 10, 11, 13
	Vanadium	275 mg/kg	13.3 mg/kg	ND (12.1 mg/kg)	34, pp. 8, 10, 11, 13
	Xylenes (total)*	2,300 µg/kg	67 µg/kg	ND (19 µg/kg)	33, pp. 8, 9, 16, 17
	Zinc	188 mg/kg	5.3 mg/kg	ND (17 mg/kg)	34, pp. 8, 10, 11, 13
SS-10	Chromium	31.7 mg/kg	2.7 mg/kg	8.0 mg/kg	34, pp. 8, 10, 11, 14
	Copper*	68.0 mg/kg	6.8 mg/kg	ND (6.0 mg/kg)	34, pp. 8, 10, 11, 14
	Ethylbenzene*	35 µg/kg	19 µg/kg	ND (19 µg/kg)	33, pp. 8, 9, 16, 17
	Fluoranthene	940 µg/kg	800 µg/kg	ND (400 µg/kg)	33, pp. 14-17
	Lead	187 mg/kg	0.81mg/kg	8.1 mg/kg	34, pp. 8, 10, 11, 14
	Naphthalene	1,300 µg/kg	800 µg/kg	ND (400 µg/kg)	33, pp. 14-17
	Nickel	20.3 mg/kg	10.9 mg/kg	ND (9.7 mg/kg)	34, pp. 8, 10, 11, 14

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit or Sample Detection Limit	Background Sample Concentration	Reference
SS-10 (Concluded)	Vanadium	25.2 mg/kg	13.6 mg/kg	ND (12.1 mg/kg)	34, pp. 8, 10, 11, 14
	Xylenes (total)	310 µg/kg	19 µg/kg	ND (19 µg/kg)	33, pp. 8, 9, 16, 17
	Zinc	234 mg/kg	5.4 mg/kg	ND (17 mg/kg)	34, pp. 8, 10, 11, 14
SS-10R/D	Chromium	29.9 mg/kg	2.8 mg/kg	8.0 mg/kg	34, pp. 8, 10, 11, 14
	Copper*	110 mg/kg	7.1 mg/kg	ND (6.0 mg/kg)	34, pp. 8, 10, 11, 14
	Ethylbenzene*	20 µg/kg	24 µg/kg	ND (19 µg/kg)	33, pp. 8, 9, 16, 18
	Fluoranthene	860 µg/kg	480 µg/kg	ND (400 µg/kg)	33, pp. 14-16, 18
	Lead	139 mg/kg	0.85mg/kg	8.1 mg/kg	34, pp. 8, 10, 11, 14
	Naphthalene	1,660 µg/kg	800 µg/kg	ND (400 µg/kg)	33, pp. 14-16, 18
	Nickel	17.4 mg/kg	11.3 mg/kg	ND (9.7 mg/kg)	34, pp. 8, 10, 11, 14
	Vanadium	23.2 mg/kg	14.1 mg/kg	ND (12.1 mg/kg)	34, pp. 8, 10, 11, 14
	Xylenes (total)	220 µg/kg	24 µg/kg	ND (19 µg/kg)	33, pp. 8, 9, 16, 18
	Zinc	168 mg/kg	5.7 mg/kg	ND (17 mg/kg)	34, pp. 8, 10, 11, 14

µg/kg = Micrograms per kilogram

mg/kg = Milligrams per kilogram

ND = Not detected.

\* = Value for substance has been adjusted due to estimated value reported during validation (see listed reference for additional details)

Values in ( ) are SQLs or SDLs for the background sample in instances where the hazardous substance was not detected in the background sample.

2.4.2. Hazardous Waste Quantity

The Hazardous Waste Quantity for Source 1 was calculated based on the Volume Factor Value for a landfill [1, p. 51591, Table 2-5, Section 2.4.2.1.3]. The Hazardous Constituent Quantity and Hazardous Wastestream Quantity Factor Values were not evaluated for Source 1, because insufficient information was available [1, pp. 51591, Table 2-5, Sections 2.4.2.1.1 and 2.4.2.1.2]. The Area Factor Value was not calculated since the volume of Source 1 has been determined [1, p. 51591, Section 2.4.2.1.3].

2.4.2.1.1. Hazardous Constituent Quantity

There is insufficient information to evaluate the source for Hazardous Constituent Quantity.

Hazardous Substance	Constituent Quantity (pounds) (Mass - s)		Reference
NE (Insufficient information)			

Sum: (pounds)

Hazardous Constituent Quantity Value (S): NE

2.4.2.1.2. Hazardous Wastestream Quantity

There is insufficient information to evaluate the source for Hazardous Wastestream Quantity.

Hazardous Wastestream	Quantity (pounds)	Reference
NE (Insufficient information)		

Sum: (pounds)

Hazardous Wastestream Quantity Value (W): NE

2.4.2.1.3. Volume

The volume of Source 1 was estimated to be 1.9 million yd<sup>3</sup> [7, p. 89, Appendix E, p. 1 of 10]. This volume estimate was derived by measuring the area of topographic contour lines within the identified waste limits of the 1995 topographic base plan and assuming a constant base elevation as being the average elevation of the limit of waste [7, p. 89, Figure 1.6-1, Appendix E, p. 1 of 10].

Dimension of source (yd<sup>3</sup> or gallons): 1.9 million yd<sup>3</sup>

References(s): 7, p. 89, Figure 1.6-1, Appendix E, p. 1 of 10

The volume of a “landfill” source type in cubic yards, is divided by 2,500 to assign a Hazardous Waste Quantity to Source 1 [1, p. 51591, Table 2-5].  $1.9 \text{ million yd}^3 \div 2,500 = 760$ .

Volume Assigned Value: 760

2.4.2.1.4. Area

Since the volume of Source 1 was determined to be 1.9 million yd<sup>3</sup>, the area of Source 1 will not be evaluated. The area value for Source 1 was not calculated and therefore assigned a zero [1, p. 51591, Section 2.4.2.1.3].

Area of source (ft<sup>2</sup>):

Reference(s):

Area Assigned Value: 0

2.4.2.1.5. Source Hazardous Waste Quantity Value

The Hazardous Waste Quantity Value for Source 1 was assigned based on the Volume Factor Value. The Hazardous Constituent Quantity and Hazardous Wastestream Quantity were not evaluated for Source 1 because insufficient information was available [1, pp. 51591, 51592]. Since the volume of Source 1 was determined to be 1.9 million yd<sup>3</sup>, the area of Source 1 will not be evaluated [1, p. 51591, Section 2.4.2.1.3]. The Area Factor Value for Source 1 was not calculated and therefore assigned a zero [1, p. 51591, Section 2.4.2.1.3].

Source Hazardous Waste Quantity Value: 760

## SOURCE DESCRIPTION

### 2.2 Source Characterization

Number of the source: 2

Name and description of the source: Drum Disposal Area (Drums)

The Drum Disposal Area (Source 2) was identified based on historical information, confidential information from a “reliable source” provided to MA DEP, geophysical surveys, test-pitting operations, analytical results, and interpretations of ongoing investigations (See Figure 3 in Attachment A of this document) [4; 7, p. 5; 31, p. 02; 83, pp. 1-12, Appendix N (Table G)].

In June 1999, MA DEP personnel conducted a magnetic survey on the property in an area which was reported to contain buried drums [31, p. 05]. MA DEP conducted test-pitting operations in the areas identified by the magnetic survey [31, p. 05]. During test-pitting operations, approximately 60 55-gallon drums were discovered in one location, test pit TP-04, within the first 5 to 10 feet below the original grade in this area [31, pp. 02, 05, 06; 56, pp. 1-1, 4-2]. The drums were not intact after years of being buried (or being crushed when buried), and most of the contents of the drums have leaked into the soil and ground water in the area of Source 2 [31, p. 02; 56, p. 4-2]. The contamination was attributed to the release of industrial solvents and chemicals used in plastics and held within the buried and crushed drums [31, pp. 02, 06]. MA DEP noted that some of the drums discovered contained a “sludge material” [31, p. 05]. On-site observations from this event also indicated that there was no membrane or fine-grained soil noted that would constitute the presence of a cover or liner material [58]. A source sample of the sludge material in one of the drums was collected on 8 June 1999 by MA DEP personnel and submitted to a private laboratory for VOC analysis by standard EPA methods [31, pp. 05, 10; 56, p. 4-3]. Analytical results of the drum sludge sample indicated the presence of VOCs [31, p. 10; 108, pp. 1, 2].

MA DEP conducted baseline air monitoring in the area of Source 2 before conducting test-pitting activities [31, p. 03]. Prior to excavation, air quality monitoring did not indicate a release to the air from Source 2 [31, p. 03]. However, elevated readings on field air monitoring instrumentation were noted in ambient air as drums were uncovered [31, p. 03]. After drum sludge samples were collected from the excavation, the area was backfilled and air quality returned to background conditions [31, p. 03; 87, p. 2].

As a result of the identification of drums, EPA START personnel conducted a magnetic and electromagnetic survey in an area surrounding Source 2 on 3 June 1999 [31, p. 05; 39, pp. 1-3]. Several anomalies indicating possible additional drum disposal locations were identified as a result of the EPA START geophysical survey; however, no drums were discovered in these areas during subsequent excavation activities [31, p. 05; 39, p. 3].

Location of the source, with reference to a map of the site:

Source 2 is located west of the northern landfill lobe and occupies a portion of Lot 35 on the Town of Tewksbury Tax Assessor’s Map Nos. 108 and 109 (see Figure 5 in Attachment A of this document) [4, pp. 1-5; 7, p. 50].

### Containment

#### Release to ground water

No evidence of a maintained engineered cover or a functioning maintained run-on control or runoff control management system was noted during excavation activities or historical on-site observations [58]. During excavation activities and other subsurface investigations of Source 2, no containment structures were noted that would be representative of a liner, and no leachate collection and removal system is in place [56, p. 4-2, Appendix B, p. 01; 58]. Evidence of hazardous substance migration from Source 2 to ground water has been established [1, p. 51596, Table 3-2; 101, pp. 9, 14, 16; 102, pp. 6, 10, 12; 103, pp. 5-8, 10, 12; 108, pp. 1, 2]. Based on these characteristics, Source 2 is assigned a Containment Factor of 10 [1, pp. 51596, 51597, Table 3-2].

#### Release via overland migration and/or flood

Based on excavation activities and on-site observations, Source 2 shows no evidence of a maintained engineered cover or a functioning maintained run-on control or runoff control management system [58]. During excavation activities and other subsurface investigations of Source 2, no form of containment structures were encountered that would be representative of a liner, and no leachate collection system is in place [56, p. 4-2, Appendix B, p. 01; 58]. Evidence of hazardous substance migration from Source 2 to surface water has been established [1, p. 51610, Table 4-2; 78, pp. 6-8; 108, pp. 1, 2]. Based on these characteristics, Source 2 is assigned a Containment Factor of 10 [1, pp. 51609, 51610, Table 4-2].

#### 2.4.1 Hazardous Substances

During on-site test-pitting operations, approximately 60 55-gallon drums were discovered [31, pp. 02, 05, 06; 56, pp. 1-1, 4-2]. The drums were not intact after years of being buried (or being crushed when buried), and most of the contents of the drums have leaked into the soil and ground water in the area of Source 2 [31, p. 02; 56, p. 4-2]. The contamination was attributed to the release of industrial solvents and chemicals used in plastics and held within the buried and crushed drums [31, pp. 02, 06]. Elevated readings on field air monitoring instrumentation were noted in ambient air as some of the drums and soil were uncovered [87, p. 2]. MA DEP noted that some of the drums discovered contained a “sludge material” [31, p. 05]. A drum sludge sample (D40) was collected from Source 2 by MA DEP personnel on 8 June 1999 [31, pp. 05, 10].

The drum sludge sample was submitted to a private laboratory for VOC analysis by standard EPA methods [31, p. 05; 108, pp. 1, 2]. Analytical results of the drum sludge sample collected by MA DEP personnel indicated the presence of ethylbenzene, toluene, and xylenes (total) [108, pp. 1, 2]. For the purpose of this evaluation, the one drum sludge sample collected by MA DEP personnel was utilized to associate hazardous substances with Source 2. There is no applicable background sample for a drum sludge sample.

<b>Hazardous Substance</b>	<b>Evidence</b>	<b>Reference</b>
Ethylbenzene	Analytical Evidence	108, pp. 1, 2
Toluene	Analytical Evidence	108, pp. 1, 2
Xylenes (total)	Analytical Evidence	108, pp. 1, 2

### Contaminated Sample

During on-site test-pitting operations, approximately 60 55-gallon drums were discovered by MA DEP personnel in one location (TP-04) within the first 5 to 10 feet below the original grade in this area (See Figure 3 in Attachment A of this document) [31, pp. 02, 05, 06; 56, pp. 1-1, 4-2]. The drums were not intact after years of being buried (or being crushed when buried), and most of the contents of the drums have leaked into the soil and ground water in the area of Source 2 [31, p. 02; 56, p. 4-2]. Elevated readings on field air monitoring instrumentation were noted in ambient air as some of the drums and soil were uncovered [31, p. 03; 87, p. 2]. MA DEP noted that some of the drums discovered contained a “sludge material” [31, p. 05]. A drum sludge sample (D40) was collected from Source 2 by MA DEP personnel on 8 June 1999 [31, p. 10; 56, p. 4-3].

The drum sludge sample was submitted to a private laboratory for VOC analysis by standard EPA methods [31, p. 05; 108, pp. 1, 2]. Analytical results of drum sludge sample D40 indicated the presence of ethylbenzene, toluene, and xylenes (total) [31, p. 10; 108, pp. 1, 2]. For the purpose of this evaluation, the drum sludge sample (D40) collected by MA DEP personnel was used to associate hazardous substances with Source 2.

Sample ID	Depth	Date	Reference
D40	5 to 10 feet	8 June 1999	31, pp. 05, 10; 56, p. 4-2, Appendix B, p. 1; 108, pp. 1, 2

Sample ID	Hazardous Substance	Concentration	Sample Detection Limit	Reference
D40	Ethylbenzene	330 mg/kg	100 mg/kg	31, p. 10; 108, pp. 1, 2
	Toluene	4,880 mg/kg	100 mg/kg	31, p. 10; 108, pp. 1, 2
	Xylenes (total)	1,360 mg/kg	100 mg/kg	31, p. 10; 108, pp. 1, 2

mg/kg = Milligrams per kilogram

2.4.2. Hazardous Waste Quantity

The Hazardous Waste Quantity for Source 2 was calculated based on the Volume Factor Value for drums [1, p. 51591, Table 2-5, Section 2.4.2.1.3]. The Hazardous Constituent Quantity and Hazardous Wastestream Quantity Factor Values were not evaluated for Source 2, because insufficient information was available [1, pp. 51591, Table 2-5, Sections 2.4.2.1.1 and 2.4.2.1.2]. A “drum” source type cannot be evaluated for its Area Factor Value [1, p. 51591, Table 2-5].

2.4.2.1.1. Hazardous Constituent Quantity

There is insufficient information to evaluate the source for Hazardous Constituent Quantity.

<b>Hazardous Substance</b>	<b>Constituent Quantity (pounds) (Mass - s)</b>	<b>Reference</b>
NE (Insufficient information)		

Sum: (pounds)

Hazardous Constituent Quantity Value (S): NE

2.4.2.1.2. Hazardous Wastestream Quantity

There is insufficient information to evaluate the source for Hazardous Wastestream Quantity.

<b>Hazardous Wastestream</b>	<b>Quantity (pounds)</b>	<b>Reference</b>
NE (Insufficient information)		

Sum: (pounds)

Hazardous Wastestream Quantity Value (W): NE

2.4.2.1.3. Volume

MA DEP personnel discovered approximately 60 buried 55-gallon drums in one area in crushed condition [31, pp. 05, 06; 56, pp. 1-1, 4-2]. According to HRS Table 2-5, if the actual volume of drums is unknown, it is assumed that one drum equals 50 gallons [1, p. 51591, Table 2-5]. The volume of Source 2 is approximately 3,000 gallons ( $60 \times 50$  gallons/drum) [31, pp. 02, 05, 06; 56, pp. 1-1, 4-2].

Dimension of source (yd<sup>3</sup> or gallons): 3,000 gallons

References(s): 31, pp. 02, 05, 06; 56, pp. 1-1, 4-2

The volume of a “drum” source type in gallons is divided by 500 to assign a Hazardous Waste Quantity to Source 2 [1, p. 51591, Table 2-5].  $3,000 \text{ gallons} \div 500 = 6$

Volume Assigned Value: 6

2.4.2.1.4. Area

A “drum” source type cannot be evaluated on Tier D (Area) [1, p. 51591, Table 2-5].

Area of source (ft<sup>2</sup>):

Reference(s):

Area Assigned Value: NE

SD-Source Hazardous Waste Quantity Value  
Source No.: 2

2.4.2.1.5. Source Hazardous Waste Quantity Value

The Hazardous Waste Quantity Value for Source 2 was assigned based on the Volume Factor Value. The Hazardous Constituent Quantity and Hazardous Wastestream Quantity were not evaluated for Source 2 because insufficient information was available [1, p. 51591, Table 2-5, Sections 2.4.2.1.1 and 2.4.2.1.2]. A “drum” source type cannot be evaluated on Tier D (Area) [1, p. 51591, Table 2-5].

Source Hazardous Waste Quantity Value: 6

## SOURCE DESCRIPTION

### 2.2 Source Characterization

Number of the source: 3

Name and description of the source: Drum Disposal Area Soils (Contaminated Soil)

The Drum Disposal Area Soils (Source 3) was identified based on historical information, confidential information from a “reliable source” provided to MA DEP, geophysical surveys, test-pitting operations, analytical results, and interpretations of on-going investigations [4; 7, p. 5; 31, pp. 02-06; 56; 83, pp. 1-12, Appendix N (Table G); 109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6].

In June 1999, MA DEP personnel conducted a magnetic survey on the property in an area which was reported to contain buried drums [31, p. 05]. MA DEP conducted test-pitting operations in the areas identified by the magnetic survey [31, p. 05]. During test-pitting operations, approximately 60 55-gallon drums were discovered in one location (TP-04) within the first 5 to 10 feet below the original grade in this area [31, pp. 02, 05, 06; 56, pp. 1-1, 4-2]. The drums were not intact after years of being buried (or being crushed when buried), and most of the contents of the drums have leaked into the soil and ground water in the area of Source 2 [31, p. 02; 56, p. 4-2]. The contamination was attributed to the release of industrial solvents and chemicals used in plastics and held within the buried and crushed drums [31, pp. 02, 06]. On-site observations from this event also indicated that there was no membrane or fine-grained soil noted that would constitute the presence of a cover or liner material [58]. Elevated readings on field air monitoring instrumentation were noted as some of the drums and soil were uncovered [31, p. 03; 87, p. 2]. Soil samples were collected from the excavated area for laboratory analysis by MA DEP [31, p. 05]. Analytical results of soil samples indicated the presence of ethylbenzene, toluene and xylenes [31, pp. 06, 10].

Additional soil samples were collected from Source 3 via a direct push device by EPA START personnel from 26 July 1999 through 10 August 1999 to determine the extent and depth of soil contamination [83, pp. 1-12]. Based on the results of on-site soil screening utilizing a Photovac 10A10, EPA START personnel collected confirmatory soil samples from Source 3 [35, pp. 4, 5; 83, pp. 1-12, Appendix N (Table G)]. The confirmatory soil samples were collected at depths of 2 to 14 feet below ground surface [83, p. 2, Appendix N (Table G)]. The soil samples were submitted to EPA’s New England Regional Laboratory (NERL) for VOC analysis by standard EPA methods [109, Attachment A, p. 1; 110, Attachment A, p. 1; 111, Attachment A, p. 1; 112, Attachment A, p. 1]. An EPA New England Tier II validation was performed on the confirmatory soil sample analytical results [109, p. 1; 110, p. 1; 111, p. 1; 112, p. 1]. Validated analytical results of subsurface soil samples collected indicated the presence of ethylbenzene, toluene, and xylenes (total) in the soil samples [109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6].

Location of the source, with reference to a map of the site:

Source 3 is located west of the northern landfill lobe and occupies a portion of Lot 35 on the Town of Tewksbury Tax Assessor’s Map Nos. 108 and 109 (see Figure 5 in Attachment A of this document) [4, pp. 1-5; 7, p. 50].

Containment

Release to ground water

No evidence of a maintained engineered cover or a functioning maintained run-on control or runoff control management system was noted during excavation activities or historical on-site observations [58]. During excavation activities and other subsurface investigations of Source 3, no containment structures were encountered that would be representative of a liner, and no leachate collection and removal system is in place [56, p. 4-2; 58]. Evidence of hazardous substance migration from Source 3 to ground water has been established [1, p. 51596, Table 3-2; 101, pp. 9, 14, 16; 102, pp. 6, 10, 12; 103, pp. 5-8, 10, 12; 109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6]. Based on these characteristics, Source 3 is assigned a Containment Factor of 10 [1, pp. 51596, 51597, Table 3-2].

Release via overland migration and/or flood

Based on excavation activities and on-site observations, Source 3 shows no evidence of a maintained engineered cover or a functioning maintained run-on control or runoff control management system [58]. During excavation activities and other subsurface investigations of Source 3, no form of containment structures were encountered that would be representative of a liner, and no leachate collection system is in place [56, p. 4-2; 58]. Evidence of hazardous substance migration from Source 3 to surface water has been established [1, p. 51610, Table 4-2; 78, pp. 6-8; 109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6]. Based on these characteristics, Source 3 is assigned a Containment Factor of 10 [1, pp. 51609, 51610, Table 4-2].

#### 2.4.1 Hazardous Substances

Soil samples were collected from Source 3 via a direct-push device by EPA START personnel from 26 July 1999 through 10 August 1999 [83, pp. 1-12]. Based on the results of on-site soil screening utilizing a Photovac 10A10, EPA START personnel collected confirmatory soil samples from Source 3 [35, pp. 4, 5; 83, pp. 1-12, Appendix N (Table G)]. The confirmatory soil samples were collected at depths of 2 to 14 feet below ground surface [83, p. 2, Appendix N (Table G)]. The soil samples were submitted to EPA's NERL for VOC analysis by standard EPA methods [109, Attachment A, p. 1; 110, Attachment A, p. 1; 111, Attachment A, p. 1; 112, Attachment A, p. 1]. An EPA New England Tier II validation was performed on the confirmatory soil sample analytical results [109, p. 1; 110, p. 1; 111, p. 1; 112, p. 1]. For the purpose of this evaluation, six of the confirmatory soil samples collected were selected to associate hazardous substances with Source 3. The hazardous substances associated with Source 3 include hazardous substances which were detected significantly above background concentrations in the six aforementioned soil samples. A hazardous substance was considered associated with Source 3 if it was detected at three times or greater than the concentration of the hazardous substance in the background sample, or if not detected in the background sample, greater than or equal to the background sample's SQL for that hazardous substance [1, pp. 51588, Section 2.2.3, 51589, Table 2-3]. The ethylbenzene, toluene, and xylenes (total) detected in the soil samples were attributed to the release of industrial solvents held within the buried, crushed drums discovered in the same area [31, pp. 02, 06].

Hazardous Substance	Evidence	Reference
Ethylbenzene	Analytical Evidence	109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6
Toluene	Analytical Evidence	109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6
Xylenes (total)	Analytical Evidence	109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6

### Background Sample

Soil sample B10-½-6 was selected from the soil samples collected from Source 3 between 26 July 1999 through 10 August 1999 as the background soil sample to characterize the concentrations of the hazardous substances in the medium of concern for the environmental setting near the site [83, pp. 1-12]. Background levels do not necessarily reflect pre-release conditions, nor conditions in the absence of influence from Source 3 [83, pp. 1-12; 112, pp. 5, 6]. The background soil sample and the six soil samples used to associate hazardous substances within Source 3 were all collected at depths of 6 to 14 feet below ground surface [83, p. 2, Appendix N (Table G)].

Sample ID	Depth	Date	Reference
B10-½-6	6 feet	9 August 1999	83, pp. 2, 9

For the purposes of this package, soil sample concentrations that are three times or greater than the background sample concentration or are greater than or equal to the background sample's SQL (if the compound was not detected in the background sample), are used to associate hazardous substances with Source 3 [1, pp. 51588, Section 2.2.3, 51589, Table 2-3].

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit	Reference
B10-½-6	Ethylbenzene*	ND	5,900 µg/kg	112, pp. 5, 6
	Toluene*	ND	962 µg/kg	112, pp. 5, 6
	Xylenes (total)*	ND	5,900 µg/kg	112, pp. 5, 6

\* = Value for substance has been adjusted due to estimated value reported during validation (see listed reference for additional details)

### Contaminated Samples

Six of the confirmatory soil samples [B9-6(E10)-6, B10-6-6, B11-6-7, B12-6-14, B13-3-12, and B15-6-11] collected from Source 3 between 26 July 1999 through 10 August 1999 will be used to associate hazardous substances with Source 3 [83, pp. 1-12]. The six soil samples define the boundaries of Source 3 and contained one or more hazardous substances at three times or greater than background sample concentrations (on-site soil sample B10-½-6); or if the hazardous substance was not detected in the background sample, greater than or equal to the background sample's SQL for that hazardous substance [1, pp. 51588, Section 2.2.3, 51589, Table 2-3].

<b>Sample ID</b>	<b>Depth</b>	<b>Date</b>	<b>Reference</b>
B9-6(E10)-6	6 feet	27 July 1999	83, pp. 2, 3
B10-6-6	6 feet	4 August 1999	83, pp. 2, 7
B11-6-7	7 feet	3 August 1999	83, pp. 2, 7
B12-6-14	14 feet	5 August 1999	83, pp. 2, 8
B13-3-12	12 feet	30 July 1999	83, pp. 2, 5
B15-6-11	11 feet	2 August 1999	83, pp. 2, 6

Contaminated Samples (Continued)

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit	Background Sample Concentration	Reference
B9-6(E10)-6	Ethylbenzene*	110,000 µg/kg	2,800 µg/kg	ND (5,900 µg/kg)	109, pp. 5, 6; 112, pp. 5, 6
	Toluene*	210,000 µg/kg	2,800 µg/kg	ND (962 µg/kg)	109, pp. 5, 6; 112, pp. 5, 6
	Xylenes (total)*	460,000 µg/kg	2,800 µg/kg	ND (5,900 µg/kg)	109, pp. 5, 6; 112, pp. 5, 6
B10-6-6	Ethylbenzene*	2,100,000 µg/kg	160,000 µg/kg	ND (5,900 µg/kg)	111, pp. 5, 6; 112, pp. 5, 6
	Toluene*	20,000,000 µg/kg	160,000 µg/kg	ND (962 µg/kg)	111, pp. 5, 6; 112, pp. 5, 6
	Xylenes (total)*	7,500,000 µg/kg	160,000 µg/kg	ND (5,900 µg/kg)	111, pp. 5, 6; 112, pp. 5, 6
B11-6-7	Ethylbenzene*	180,000 µg/kg	45,000 µg/kg	ND (5,900 µg/kg)	111, pp. 5, 6; 112, pp. 5, 6
	Toluene*	510,000 µg/kg	45,000 µg/kg	ND (962 µg/kg)	111, pp. 5, 6; 112, pp. 5, 6
	Xylenes (total)*	540,000 µg/kg	45,000 µg/kg	ND (5,900 µg/kg)	111, pp. 5, 6; 112, pp. 5, 6
B12-6-14	Ethylbenzene*	13,000 µg/kg	960 µg/kg	ND (5,900 µg/kg)	112, pp. 5, 6
	Toluene*	28,000 µg/kg	960 µg/kg	ND (962 µg/kg)	112, pp. 5, 6
	Xylenes (total)*	52,000 µg/kg	960 µg/kg	ND (5,900 µg/kg)	112, pp. 5, 6
B13-3-12	Ethylbenzene*	170,000 µg/kg	59,000 µg/kg	ND (5,900 µg/kg)	110, pp. 5, 6; 112, pp. 5, 6
	Toluene*	960,000 µg/kg	59,000 µg/kg	ND (962 µg/kg)	110, pp. 5, 6; 112, pp. 5, 6
	Xylenes (total)*	660,000 µg/kg	59,000 µg/kg	ND (5,900 µg/kg)	110, pp. 5, 6; 112, pp. 5, 6
B15-6-11	Ethylbenzene*	50,000 µg/kg	1,100 µg/kg	ND (5,900 µg/kg)	111, pp. 5, 6; 112, pp. 5, 6
	Xylenes (total)*	85,000 µg/kg	1,100 µg/kg	ND (5,900 µg/kg)	111, pp. 5, 6; 112, pp. 5, 6

µg/kg = micrograms per kilogram.

ND = Not detected;

() = Background sample SQL or SDL.

\* = Value for substance has been adjusted due to estimated value reported during validation (see listed reference for additional details).

2.4.2. Hazardous Waste Quantity

The Hazardous Waste Quantity for Source 3 was calculated based on the Area Factor Value for contaminated soil [1, p. 51591, Table 2-5, Section 2.4.2.1.4]. The Hazardous Constituent Quantity, Hazardous Wastestream Quantity, and Volume Factor Values were not evaluated for Source 3, because insufficient information was available [1, pp. 51591, Table 2-5, Sections 2.4.2.1.1, 2.4.2.1.2, and 2.4.2.1.3].

2.4.2.1.1. Hazardous Constituent Quantity

There is insufficient information to evaluate the source for Hazardous Constituent Quantity.

<b>Hazardous Substance</b>	<b>Constituent Quantity (pounds) (Mass - s)</b>	<b>Reference</b>
NE (Insufficient information)		

Sum: (pounds)

Hazardous Constituent Quantity Value (S): NE

2.4.2.1.2. Hazardous Wastestream Quantity

There is insufficient information to evaluate the source for Hazardous Wastestream Quantity.

<b>Hazardous Wastestream</b>	<b>Quantity (pounds)</b>	<b>Reference</b>
NE (Insufficient information)		

Sum: (pounds)

Hazardous Wastestream Quantity Value (W): NE

#### 2.4.2.1.3. Volume

There is insufficient information to evaluate the source for volume [1, p. 51591, Section 2.4.2.1.3]. The Volume Factor Value for Source 3 is therefore assigned a zero [1, p. 51591, Section 2.4.2.1.3].

Dimension of source (yd<sup>3</sup> or gallons):

References(s): 1, p. 51591, Section 2.4.2.1.3

Volume Assigned Value: 0

#### 2.4.2.1.4. Area

EPA START personnel collected subsurface soil samples from Source 3 [83, pp. 1-12]. During this investigation, an area of contaminated soil was discovered [83, pp. 1-12]. The location of each soil sample collection point was recorded utilizing a Trimble™ Global Positioning System (GPS) receiver [81, pp. 1, 2]. The recorded soil sample GPS points were electronically imported into ArcView® Geographic Information System (GIS) software (version 3.1) by EPA START personnel [81, pp. 1, 2]. A polygon was drawn connecting confirmed contaminated soil sample locations B9-6(E10)-6, B10-6-6, B11-6-7, B12-6-14, B13-3-12, and B15-6-11 [81, pp. 1, 2]. ArcView® GIS calculated the area for Source 3 from this polygon [81, pp. 1, 2]. The area of Source 3, as determined by ArcView® GIS, is approximately 11,738 square feet [81, pp. 1, 2].

Area of source (ft<sup>2</sup>): 11,738 ft<sup>2</sup>

Reference(s): 81, pp. 1, 2

The area of a “contaminated soil” source type, in square feet, is divided by 34,000 to assign a Hazardous Waste Quantity to Source 3 [1, p. 51591, Table 2-5].  $11,738 \text{ square feet} \div 34,000 = 0.35$

Area Assigned Value: 0.35

SD-Source Hazardous Waste Quantity Value  
Source No.: 3

2.4.2.1.5. Source Hazardous Waste Quantity Value

The Hazardous Waste Quantity Value for Source 3 was assigned based on the Area Factor Value. The Hazardous Constituent Quantity, Hazardous Wastestream Quantity, and Volume Factor value were not evaluated for Source 3 because insufficient information was available [1, pp. 51591, Table 2-5, Sections 2.4.2.1.1, 2.4.2.1.2, 2.4.2.1.3].

Source Hazardous Waste Quantity Value: 0.35

### SITE SUMMARY OF SOURCE DESCRIPTIONS

Source No.	Source Hazardous Waste Quantity Value	Containment			
		Groundwater	Surface Water	Gas	Air Particulate
1	760	10	10	NS	NS
2	6	10	10	NS	NS
3	0.35	10	10	NS	NS

NS = Not Scored

Total Source Hazardous Waste Quantity Value: 766.35

The following other possible sources have been identified during previous investigations but have not been evaluated as part of this HRS Documentation Record:

#### Storage Trailer Area (Drums, Tanks, Non-drum Containers, and Other)

A number of open storage trailers are located east of the on-site warehouse building [3, p. 22]. During the 19 March 1999 on-site reconnaissance, EPA START observed an area containing 19 lead-acid batteries on the ground surface adjacent to the warehouse building [3, pp. 1, 22]. Some of the batteries were broken or without seals [3, p. 22]. South of the batteries, a piece of construction equipment with an estimated 40-gallon fuel tank had released oil to the ground surface [3, p. 22]. Just east of the warehouse building was a storage trailer containing tires, a compressed gas cylinder, and a 55-gallon drum [3, p. 22]. EPA START was unable to determine the contents of the drum or cylinder [3, p. 22]. Another gas cylinder, labeled as containing a flammable material, was observed outside and to the east of the trailer [3, p. 22]. Two 250-gallon oil storage tanks are located north of the warehouse building [3, pp. 22, 24]. It is unknown to EPA START if the oil tanks contain waste or fuel oil [3, p. 22]. The trailer, drum, piece of construction equipment with a leaking 40-gallon fuel tank, and batteries are located more than 200 feet from the nearest residence [3, p. 22]. The oil storage tanks and the warehouse building are within 200 feet of the on-site residence [3, p. 22].

Because insufficient information is currently available regarding the specific hazardous substances associated with these possible source materials, and because the inclusion of this source would not significantly affect the overall site score, the Storage Trailer Area source has not been evaluated for inclusion in the HRS package.

Additional Drum Disposal Areas (Drums/Contaminated Soil)

There are several additional locations in the vicinity of the other source areas where buried and non-buried drum remnants have been discovered, or are suspected to be located [69, pp. 1-1, 4-3; 70, p. 2]. Analytical results of samples collected from the drums and soil samples collected in and around the drums at two of these areas have documented releases of VOCs, SVOCs, and inorganic elements [69, pp. 4-6 to 4-9; 70, pp. 2-4]. Available information does not indicate how the drums came to be located at the nearby locations, or whether they were disposed of by the same parties responsible for the Drum Disposal Area evaluated as part of the Sutton Brook Disposal Area site [91, p. 1]. These potential additional sources have not been evaluated in the HRS package because only limited analytical information is currently available [69, pp. 1-1, 4-3; 70, p. 2]. However, EPA and the state are continuing to investigate these suspected source areas, and as more information becomes available, EPA will determine whether the boundaries of the Sutton Brook Disposal Area site should be expanded to include these additional source areas [91, p. 2].

The first nearby drum disposal area is located on a wooded property northeast of McDonald Road in Wilmington, Massachusetts [69, pp. 1-1, 3-1]. The McDonald Road Drum Disposal Area is located approximately 0.75 miles south of the other sources included with the Sutton Brook Disposal Area (see Figure 2 in Attachment A of this document) [69, p. 3-1]. Beginning in June 1999, a magnetometer survey was conducted within four areas that were identified during interviews with local residents as possible drum disposal areas [69, pp. 1-1, 4-3]. Subsurface anomalies were detected and likely drum disposal areas were surveyed and mapped for test pit excavation activities [69, pp. 1-1, 4-3]. In June and July 1999, MA DEP contractors conducted test pitting operations in the suspected areas, revealing the remains of approximately 50 55-gallon drums [69, pp. 1-1, 1-2]. Further geophysical surveys and subsequent test pitting excavations conducted in October and November 1999 revealed the remains of approximately 50 additional 55-gallon drums [69, pp. 1-1, 1-2]. Analytical results of soil samples collected from the test pits detected concentrations of ethylbenzene, toluene, and xylenes (total) [69, pp. 4-6 to 4-9]. Analytical results of ground water samples collected from monitoring wells in and around the McDonald Road Drum Disposal Area revealed the presence of the same hazardous substances [69, pp. 4-18, 4-21].

The second nearby drum disposal area is located on the Krochmal Farm property in Wilmington, Massachusetts, and is referred to as the Wilmington Drum Disposal Area [70, pp. 2, 3]. The Wilmington Drum Disposal Area is located approximately 0.2 miles south of the Rocco property and approximately 1/3 mile north of the McDonald Road Drum Disposal Area (see Figure 2 in Attachment A of this document) [70, pp. 2, 3]. A magnetometer survey was conducted along a dirt road leading from the McDonald Road Drum Disposal Area to the Krochmal Farm property [70, p. 2]. Approximately 100 drums were discovered protruding from a berm that separates the Krochmal Farm pumpkin field from a small pond and associated wetlands [70, p. 2]. Subsurface anomalies were detected in one area and likely drum disposal areas were surveyed and mapped for test pit excavation activities [70, p. 2]. Shallow test pits excavated in the area revealed the remains of 50 drums and contaminated soil [70, p. 2]. The 50 drums were adjacent to the drum-containing berm [70, p. 2]. Analytical results of drum contents and soil samples collected from within the test pits revealed concentrations of ethylbenzene, toluene, and xylenes (total) [70, pp. 2, 4].

### 3.0 GROUND WATER MIGRATION PATHWAY

#### 3.0.1 GENERAL CONSIDERATIONS

Aquifer/Stratum: 1

Aquifer/Stratum Name: Interconnected Overburden/Bedrock Aquifer

Description:

Soils on the site consist of four types, including Freetown muck, Windsor loamy sand, Landfills/dumps, and Udorthents, wet substratum [40, pp. 29, 31, 32]. Freetown series soils are deep, very poorly drained organic soils in depressions and on flat areas of uplands and glacial outwash plains; on the site, these soils are confined to the vicinity of Sutton Brook and its associated wetlands [40, pp. 18, 28, 32]. Windsor series soils are level to steep, excessively drained soils on glacial outwash plains, terraces, deltas, and escarpments, formed in sandy outwash with rapid permeability; on the site, these soils are confined to the area northwest of the northern landfill lobe [40, pp. 27, 29, 32]. Landfills/dumps soils consist of areas used for residential or industrial solid waste disposal, commonly containing a wide variety of wastes and subject to subsidence; on the site, this soil type is limited to the northern landfill lobe and the area immediately to the northwest of the landfill [40, pp. 19, 29, 32]. Udorthents, wet substratum, consists of gently sloping areas that were previously tidal marsh, flood plains, bays, harbors, and swamps that have been filled; on the site, these soils are limited to the southern landfill lobe [40, pp. 26, 31, 32].

Surficial geological deposits beneath the site are characterized by Quaternary swamp deposits, commonly overlying undifferentiated sand and gravel deposits [7, p. 34]. In the northwest corner of the site, surficial geology is mapped as Kame Plain deposits of sand and pebble to cobble gravel [7, p. 33]. Overburden at the site consists mainly of glacial deposits which can be divided into two lithologies; stratified glacial drift and unconsolidated glacial till [7, p. 40]. The stratified glacial drift deposit is characteristically a gray or tannish-gray, silty, coarse to fine sand with some gravel [7, p. 40]. Stratified drift deposits beneath the site range in thickness from 12 feet in the vicinity of monitoring well MW-0006 to 102 feet in the vicinity of monitoring well WEB-03 [3, p. 105; 7, p. 40; 41, p. 06].

The unconsolidated glacial till deposit is characteristically a gray, dense, silt with varying amounts of coarse to fine sand and gravel, and a high degree of cohesiveness [7, p. 40]. In most areas beneath the site, the unconsolidated glacial till is found in a layer approximately 5 feet thick separating stratified glacial drift and bedrock portions of the aquifer [7, pp. 36-39]. However, in the vicinity of monitoring well MW-002B, no evidence of the unconsolidated glacial till layer was found, indicating that the layer is not continuous beneath the site [7, p. 37, Appendix A, p. 03]. Regionally, the unconsolidated glacial till layer is considered discontinuous, which is consistent with the observations in the vicinity of MW-002B [27, pp. 1, 2].

Bedrock in the area, which is composed of biotite-muscovite granite containing 50 to 60% feldspar, 40 to 50% quartz and 10 to 20% mica, is interpreted to be the Andover Granite [7, pp. 40, 56]. At some locations beneath the site, the bedrock was noted to have a weathered surface [7, pp. 36-40]. The bedrock in the vicinity of the site comprises rocks of the Nashoba Terrane, composed of Ordovician age mafic volcanic and volcanogenic sedimentary rocks that were polydeformed and metamorphosed from mid-Ordovician to Silurian times [7, pp. 31, 56, 57]. Widespread plutonism within the terrane included the intrusion of alkaline-granitic and mafic magmas which are thought to have produced the heat that likely generated the Andover Granite through anatexis or remelting of pre-existing sedimentary rocks [7, p. 31]. The bedrock within 4 miles of the site is not composed of limestone or dolomite, and is therefore, not classified as karst [7, pp. 31, 32, 40; 72, p. 513]. The depth to bedrock beneath the site ranges from 22 to 102 feet below ground surface [7, p. 40; 3, p. 105; 41, p. 6]. Three bedrock outcrops are located near the site; all of the outcrops consisted of biotite-muscovite granite interpreted to be the Andover Granite [7, pp. 56, 57].

Ground water beneath the site generally exists in the overburden portion of the aquifer at a depth of 5 feet below ground surface [7, p. 46]. In most cases, overburden consisted of coarse-grained sediments (coarse to fine sand) interpreted to be stratified drift [7, p. 46]. Ground water is also present in the crystalline bedrock underlying the site [7, p. 46]. Ground water is contained and transmitted in the very fractured, weathered bedrock or in secondary interstices, such as joints or fractures, in more competent bedrock [7, p. 46]. Hydraulic conductivities were not measured at the site [7, p. 46]. From HRS Table 3-6, the typical hydraulic conductivities of sands or moderately permeable fractured igneous and metamorphic rocks are  $10^{-4}$  centimeters per second (cm/sec) [1, p. 51601]. Also from HRS Table 3-6, the typical hydraulic conductivity of moderately permeable glacial till is  $10^{-6}$  cm/sec [1, p. 51601]. If the unconsolidated glacial till were continuous for 2 miles from the site, it would constitute a low-permeability aquifer discontinuity between the overburden and bedrock portions of the aquifer [1, p. 51595, Section 3.0.1.2.1]. The lack of unconsolidated glacial till noted in monitoring well MW-002B and observation of three bedrock outcrops located within 1 mile of the site demonstrates that the unconsolidated glacial till is not continuous beneath the site or within 2 miles of the site and does not, therefore, constitute an aquifer discontinuity [1, p. 51595, Section 3.0.1.2.2; 7, pp. 37, 56, 57, Appendix A, p. 03]. Ground water samples collected from monitoring wells completed in the overburden portion of the aquifer indicate the presence of hazardous substances (arsenic and toluene) which are also present in ground water samples collected from monitoring wells completed in the bedrock portion of the aquifer [7, Attachment B, p. 07; 56, Appendix E, pp. 7-9, 14, 15; 98, p. 12; 100, p. 6; 101, p. 16; 103, p. 8]. For the purposes of this evaluation, a single, interconnected overburden/bedrock aquifer is considered to exist within 4-radial miles of the site.

Regional ground water flow is in a west-southwesterly direction [7, pp. 43, 45]. Locally, ground water appears to flow toward the on-site brook (Sutton Brook) [31, p. 02]. Leachate staining or discoloration was evident in Sutton Brook between the two lobes of the landfill (Source 1), as well as along the wetlands at the northern lobe of the landfill and along the south slope of the northern landfill [7, p. 49]. An oily sheen of "small extent" was noted at the location of the bridge between the two landfill lobes [7, p. 49]. These observations of leachate escaping Source 1 suggest that at least some component of ground water flow from beneath the landfill discharges to surface water.

### 3.1 LIKELIHOOD OF RELEASE

#### 3.1.1 OBSERVED RELEASE

Aquifer Being Evaluated: Aquifer 1

##### Direct Observation:

Although anecdotal evidence indicates that waste was disposed of below the water table at the site, there is not sufficient evidence to document an observed release to ground water from sources at the site by direct observation [7, pp. 6, 11, 22].

##### Chemical Analysis:

##### Background Samples

EPA START collected ground water samples from the site and the surrounding area between 13 September and 17 September 1999 [3, pp. 120-132]. Sampling activities were conducted in accordance with the EPA New England approved Task Work Plan dated 6 July 1999 and approved 13 July 1999 [76]. The ground water samples were collected using the EPA Region I Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells [3, p. 136; 76, p. 49]. This procedure provides a general framework for collecting ground water samples that are indicative of flow conditions (both the dissolved fraction and the fraction associated with mobile particles) [106, p. 1 of 13]. The ground water samples were analyzed for VOCs, SVOCs, pesticides, PCBs, total metals and cyanide by EPA CLP and Delivery of Analytical Services (DAS) laboratories using standard EPA methods [98, Attachment A, p. 01; 99, Attachment A, p. 01; 100, Attachment A, p. 1; 101, Attachment A, p. 01; 102, Attachment A, p. 01; 103, Attachment A, p. 01]. The analytical results were validated according to EPA New England Tier II requirements [98, p. 1; 99, p. 1; 100, p. 1; 101, p. 1; 102, p. 1; 103, p. 1]. Two ground water samples (GW-02 and GW-08) were collected at two nearby locations beyond the limits of the site (see Figure 6 in Attachment A of this document). Ground water sample GW-02 was selected as a background sample for ground water in the bedrock portion of Aquifer 1 due to its location outside the boundary and crossgradient of the site (see Figure 6 in Attachment A of this document) [3, pp. 126, 127; 98, pp. 7, 10; 101, pp. 7, 13, 16]. Ground water sample GW-08 was selected as a background ground water sample for ground water in the overburden portion of Aquifer 1 due to its location outside the boundary and upgradient of the site (see Figure 6 in Attachment A of this document) [3, pp. 126, 127; 98, pp. 5, 6; 102, pp. 7, 11, 12].

The sample depth for ground water samples was based on the mid-point of the well screen or borehole of the well from which the sample was collected. Because of the variability of the depth of the overburden/bedrock interface, the selection of background monitoring wells was based on relative location within the aquifer, not their measured depth/elevation based on a datum [3, pp. 126-129, 131, 132; 7, p. 39, Appendix B, pp. 05-07; 41, pp. 06, 11, 12; 56, Appendix E, pp. 7-9, 14, 15]. The bedrock monitoring wells from which the ground water samples were collected (GW-02, GW-10, GW-20 and GW-21) are all completed at the top of the bedrock portion of the aquifer, which ranges from 22.2 to 120 feet deep in the vicinity of the site [3, pp. 126, 128, 131, 132; 7, Appendix B, pp. 05, 07; 41, p. 06]. The overburden monitoring wells from which the ground water samples were collected (GW-08, GW-12, GW-13, GW-19 and GW-23) are all screened at or near the bottom of the overburden portion of the aquifer, which ranges from 22.2 to 120 feet deep in the vicinity of the site [3, pp. 127, 128, 129, 132; 7, p. 39, Appendix B, p. 06; 41, pp. 06, 11, 12; 56, Appendix E, pp. 7-9, 14, 15]. The background samples were, therefore, collected from wells that were screened at comparable depths to the wells from which contaminated samples were collected [3, pp. 126-132; 7, p. 39, Appendix B, pp. 5-7; 41, pp. 06, 11, 12; 56, Appendix E, pp. 7-9, 14, 15].

For the purpose of this evaluation, four VOCs (benzene, ethylbenzene, toluene, and xylenes (total)), one SVOC (naphthalene), and seven inorganic elements (arsenic, barium, cobalt, manganese, nickel, sodium, and zinc), detected in downgradient ground water samples and attributable to the site, will be used to evaluate the ground water pathway.

Sample ID	Depth / Type	Date	Reference
GW-02	120 feet / Bedrock	13 September 1999	3, p. 126; 41, p. 06
GW-08	47 feet / Overburden	15 September 1999	3, p. 127; 41, p. 12

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit or Sample Detection Limit	Reference
GW-02 (Bedrock)	Arsenic	0.0149 mg/L	0.01 mg/L	98, pp. 7, 10
	Barium	ND	0.2 mg/L	98, pp. 7, 10
	Benzene	ND	10 mg/L	98, pp. 7, 10
	Cobalt	ND	0.05 mg/L	98, pp. 7, 10
	Manganese*	0.0371 mg/L	0.015 mg/L	98, pp. 7, 10
	Naphthalene	ND	10 $\mu$ g/L	101, pp. 7, 13, 16
	Nickel	ND	0.04 mg/L	98, pp. 7, 10
	Sodium	20.2 mg/L	5 mg/L	98, pp. 7, 10
	Toluene	ND	10 $\mu$ g/L	101, pp. 7, 13, 16
	Zinc	0.0226 mg/L	0.02 mg/L	98, pp. 7, 10
GW-08 (Overburden)	Arsenic	0.0395 mg/L	0.01 mg/L	99, pp. 5, 6
	Barium	ND	0.2 mg/L	99, pp. 5, 6
	Benzene	ND	10 $\mu$ g/L	102, pp. 7, 11, 12
	Cobalt	ND	0.05 mg/L	99, pp. 5, 6
	Ethylbenzene	ND	10 $\mu$ g/L	102, pp. 7, 11, 12
	Lead	ND	0.003 mg/L	99, pp. 5, 6
	Manganese*	2.624 mg/L	0.015 mg/L	99, pp. 5, 6
	Silver	ND	0.01 mg/L	99, pp. 5, 6
	Sodium*	62.496 mg/L	5 mg/L	99, pp. 5, 6
	Toluene	ND	10 $\mu$ g/L	102, pp. 7, 11, 12
	Xylenes (total)	ND	10 $\mu$ g/L	102, pp. 7, 11, 12
	Zinc	ND	0.02 mg/L	99, pp. 5, 6

mg/L = milligrams per liter

$\mu$ g/L = micrograms per liter

\* = Value for substance has been adjusted due to estimated value reported during validation (see listed reference for additional details)

## Contaminated Samples

EPA START collected ground water samples from the site between 13 September and 17 September 1999 [3, pp. 126-132]. Sampling activities were conducted in accordance with the EPA New England approved Task Work Plan dated 6 July 1999 and approved 13 July 1999 [76]. The ground water samples were collected using the EPA Region I Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells [3, p. 136; 76, p. 49]. This procedure provides a general framework for collecting ground water samples that are indicative of flow conditions (both the dissolved fraction and the fraction associated with mobile particles) [106, p. 1 of 13]. The ground water samples were submitted to EPA CLP and private laboratories for VOC, SVOC, pesticide, PCB, total metal, and cyanide analyses by standard EPA methods [98, Attachment A, p. 01; 99, Attachment A, p. 01; 100, Attachment A, p. 1; 101, Attachment A, p. 01; 102, Attachment A, p. 01; 103, Attachment A, p. 01]. The analytical results were validated according to EPA New England Tier II requirements [98, p. 1; 99, p. 1; 100, p. 1; 101, p. 1; 102, p. 1; 103, p. 1]. For the purpose of this evaluation, seven ground water samples (GW-10, GW-12, GW-13, GW-19, GW-20, GW-21 and GW-23), collected downgradient of the sources at the site, have been selected to document an observed release of hazardous substances to ground water from the site. Each of these ground water samples contained hazardous substances attributed to the site at concentrations three times or greater than the background sample concentration, or, if the hazardous substance was not detected in the background sample, greater than or equal to the background sample's SQL (for organic compounds) or SDL (for inorganic elements) for that hazardous substance [1, p. 51589, Table 2-3].

The sample depth for ground water samples was based on the mid-point of the well screen or borehole of the well from which the sample was collected. Because of the variability of the depth of the overburden/bedrock interface, the selection of background monitoring wells was based on relative location within the aquifer, not their measured depth/elevation based on a datum [3, pp. 126-129, 131, 132; 7, p. 39, Appendix B, pp. 05-07; 41, pp. 06, 11, 12; 56, Appendix E, pp. 7-9, 14, 15]. Contaminated ground water sample analytical results have been compared to background ground water samples that have been collected from the same portion of the aquifer; bedrock ground water samples GW-10, GW-20 and GW-21 were compared to background ground water sample GW-02 and overburden ground water samples GW-12, GW-13, GW-19 and GW-23 were compared to background ground water sample GW-08. The bedrock monitoring wells from which the ground water samples were collected are all completed at the top of the bedrock portion of the aquifer, which ranges from 22.2 to 120 feet below ground surface in the vicinity of the site [3, pp. 126, 128, 131, 132; 7, Appendix B, pp. 05, 07; 41, p. 06]. The overburden monitoring wells from which the ground water samples were collected are all screened at or near the bottom of the overburden portion of the aquifer, which ranges from 22.2 to 120 feet below ground surface in the vicinity of the site [3, pp. 127, 128, 129, 132; 7, p. 39, Appendix B, p. 06; 41, pp. 06, 11, 12; 56, Appendix E, pp. 7-9, 14, 15]. The background samples were, therefore, collected from wells that were screened at comparable depth locations to the wells from which contaminated samples were collected [3, pp. 126-132; 7, p. 39, Appendix B, pp. 5-7; 41, pp. 06, 11, 12; 56, Appendix E, pp. 7-9, 14, 15].

Sample ID	Depth / Type	Date	Reference
GW-10	49.0 feet / Bedrock	16 September 1999	3, p. 128; 7, Attachment B, p. 05
GW-12	28.7 feet / Overburden	16 September 1999	3, p. 128; 56, Appendix E, pp. 7-9
GW-13	23.5 feet / Overburden	17 September 1999	3, p. 129; 56, Appendix E, pp. 14, 15
GW-19	22.2 feet / Overburden	16 September 1999	3, p. 131; 7, Attachment B, p. 06
GW-20	40.7 feet / Bedrock	14 September 1999	3, p. 131; 7, Attachment B, p. 07
GW-21	40.7 feet / Bedrock	14 September 1999	3, p. 132; 7, Attachment B, p. 07
GW-23	23.5 feet / Overburden	17 September 1999	3, p. 132; 56, Appendix E, pp. 7-9

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit or Sample Detection Limit	Reference
GW-10	Manganese*	0.592 mg/L	0.015 mg/L	98, pp. 7, 11
	Zinc	0.098 mg/L	0.020 mg/L	98, pp. 7, 11
GW-12	Arsenic	1.460 mg/L	0.01 mg/L	98, pp. 8, 11
	Benzene	45 µg/L	10 µg/L	102, pp. 6, 12
	Ethylbenzene	1,700 µg/L	10 µg/L	102, pp. 6, 12
	Sodium	219 mg/L	5 mg/L	98, pp. 8, 11
	Toluene	11,000 µg/L	10 µg/L	102, pp. 6, 12
	Xylenes (total)	4,700 µg/L	10 µg/L	102, pp. 6, 12
GW-13	Arsenic	0.563 mg/L	0.01 mg/L	100, pp. 5, 6
	Cobalt	0.121 mg/L	0.05 mg/L	100, pp. 5, 6
	Manganese	13.9 mg/L	0.015 mg/L	100, pp. 5, 6
	Silver	0.0536 mg/L	0.01 mg/L	100, pp. 5, 6
	Toluene*	160,000 µg/L	20,000 µg/L	103, pp. 5, 8
	Xylenes (total)*	49,000 µg/L	20,000 µg/L	103, pp. 5, 8
GW-19	Arsenic	0.226 mg/L	0.01 mg/L	98, pp. 8, 11
	Barium	1.380 mg/L	0.2 mg/L	98, pp. 8, 11
	Ethylbenzene	160 µg/L	100 µg/L	102, pp. 6, 12
	Cobalt*	0.0538 mg/L	0.050 mg/L	98, pp. 8, 11
	Lead*	0.0144 mg/L	0.003 mg/L	98, pp. 8, 11
	Manganese*	20.2 mg/L	0.015 mg/L	98, pp. 8, 11
	Sodium	363 mg/L	5 mg/L	98, pp. 8, 11
	Toluene	4,400 µg/L	0.1 mg/L	102, pp. 6, 12
	Xylenes (total)	490 µg/L	100 µg/L	102, pp. 6, 12
	Zinc	0.0238 mg/L	0.02 mg/L	98, pp. 8, 11
GW-20	Arsenic	1.35 mg/L	0.01 mg/L	98, pp. 9, 12
	Barium	1.35 mg/L	0.2 mg/L	98, pp. 9, 12
	Cobalt	0.0605 mg/L	0.05 mg/L	98, pp. 9, 12
	Manganese*	0.794 mg/L	0.015 mg/L	98, pp. 9, 12
	Naphthalene*	24 µg/L	10 µg/L	101, pp. 14, 16
	Nickel*	0.0774 mg/L	0.04 mg/L	98, pp. 9, 12
	Toluene	13,000 µg/L	1,000 µg/L	101, pp. 9, 16

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit or Sample Detection Limit	Reference
GW-21	Arsenic	1.39 mg/L	0.01 mg/L	98, pp. 9, 12
	Barium	1.4 mg/L	0.2 mg/L	98, pp. 9, 12
	Cobalt	0.0632 mg/L	0.05 mg/L	98, pp. 9, 12
	Manganese*	0.831 mg/L	0.015 mg/L	98, pp. 9, 12
	Nickel*	0.0829 mg/L	0.04 mg/L	98, pp. 9, 12
	Sodium	445 mg/L	5 mg/L	98, pp. 9, 12
	Toluene	10,000 $\mu$ g/L	2,000 $\mu$ g/L	101, pp. 9, 16
GW-23	Arsenic	0.498 mg/L	0.01 mg/L	100, pp. 5, 6
	Cobalt	0.11 mg/L	0.05 mg/L	100, pp. 5, 6
	Manganese	13.6 mg/L	0.015 mg/L	100, pp. 5, 6
	Silver	0.0453 mg/L	0.01 mg/L	100, pp. 5, 6
	Toluene*	78,000 $\mu$ g/L	50,000 $\mu$ g/L	103, pp. 5, 8

mg/L = milligrams per liter

$\mu$ g/L = micrograms per liter

\* = Value for substance has been adjusted due to estimated value reported during validation (see listed reference for additional details)

Attribution:

Attribution of hazardous substances in the ground water at the site is based on historical information and chemical analysis. Historically, wastes received by Rocco's Landfill included solvents, sanitary sewage sludge (containing unknown amounts of hazardous materials), paint sludges, and steel drum reconditioning waste [7, p. 5]. Historical information indicates that unknown quantities of municipal, commercial, and industrial wastes were disposed of in the Landfill (Source 1) and included paint sludges containing benzene, ethanol, ethyl acetate, methanol, methylene chloride, naphtha, polyvinyl acetate, toluene, turpentine, and aluminum [7, p. 5; 26, p. 17]. Dumping of scrap metal, construction debris, asphalt and petroleum-contaminated sludges reportedly continued on the property through 1988 [7, p. 5].

On 26 October 1989, EPA contractors collected 13 shallow soil samples from Source 1 [9, p. 10]. The shallow soil samples were analyzed for Superfund List organic compounds and inorganic elements through EPA CLP [9, p. 10]. The equivalent of an EPA New England Tier II validation was performed on the data [33, p. 1; 34, p. 1]. VOCs, SVOCs, and inorganic elements were detected in Source 1 at concentrations significantly greater than background criteria. The hazardous substances detected in Source 1 included barium, chromium, copper, ethylbenzene, lead, manganese, naphthalene, nickel, vanadium, xylenes (total), and zinc [33, pp. 7-9, 13-16; 34, pp. 7, 8, 10-13]. It is unlikely that the 13 shallow soil samples collected by EPA contractors in 1989 completely characterize hazardous substances disposed of in the 1.9 million yd<sup>3</sup> Source 1 between 1957 and 1988 [7, pp. 4, 5, 89, Appendix E, p. 1 of 10; 9, p. 10]. Therefore, additional hazardous substances which meet observed release criteria in groundwater samples collected downgradient of Source 1, although not detected in shallow soil samples collected from Source 1 (arsenic, cobalt, silver, and sodium), are also considered associated with Source 1, as no definitive information indicates that the hazardous substances could not be present in the source [1, p. 51588, Section 2.2.2].

A drum sludge sample was collected from Source 2 by MA DEP personnel on 8 June 1999 [31, pp. 5, 10]. The drum sludge sample was submitted to a private laboratory for VOC and SVOC analyses by standard EPA methods [108, pp. 1, 2]. Analytical results of the drum sludge sample collected by MA DEP personnel indicated the presence of ethylbenzene, toluene, and xylenes (total) [108, pp. 1, 2].

Soil samples were collected from Source 3 via a direct push device by EPA START personnel from 26 July 1999 through 10 August 1999 [35, pp. 4, 5; 83, pp. 1-12, Appendix N (Table G)]. The soil samples were submitted to EPA's NERL for VOC analysis by standard EPA methods [109, Attachment A, p. 1; 110, Attachment A, p. 1; 111, Attachment A, p. 1; 112, Attachment A, p. 1]. An EPA New England Tier II validation was performed on the confirmatory soil sample analytical results [109, p. 1; 110, p. 1; 111, p. 1; 112, p. 1]. The six soil samples contained one or more of the following hazardous substances: ethylbenzene, toluene, and xylenes (total) [109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6].

Of the 14 hazardous substances which meet observed release criteria in downgradient ground water samples, three hazardous substances (benzene, naphthalene (identified as naphtha in the reference), and toluene) are known constituents of waste disposed of in Source 1 [7, p. 5; 26, p. 17]. Seven of the 14 hazardous substances which meet observed release criteria in downgradient ground water samples (barium, ethylbenzene, lead, manganese, toluene, xylenes (total), and zinc) were detected in source samples collected by EPA contractors, MA DEP, or EPA START personnel from sources at the site [33, pp. 7, 9, 13-16; 34, pp. 7, 8, 10-13; 98, pp. 7-10; 99, pp. 5, 6; 100, pp. 5, 6; 101, pp. 7, 9, 13, 14, 16; 102, pp. 6, 7, 10-12; 103, pp. 5-8, 10, 12; 108, pp. 1, 2; 109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6].

Based on the correlation of hazardous substances associated with the sources at the site and the hazardous substances which meet observed release criteria in ground water samples downgradient of the site, the observed release to ground water is considered attributable to the site. Additionally, based on the lack of organic compounds and the presence of inorganic elements at naturally-occurring trace levels in the background ground water samples, there does not appear to be any additional sources contributing to the observed release to ground water from the site [33, pp. 7, 9, 13-16; 34, pp. 7, 8, 10-13; 98, pp. 7-10; 99, pp. 5, 6; 100, pp. 5, 6; 101, pp. 7, 9, 13, 14, 16; 102, pp. 6, 7, 10-12; 103, pp. 5-8, 10, 12; 108, pp. 1, 2; 109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6].

Hazardous Substances Released

The following hazardous substances have been released to ground water from sources at the site: arsenic, barium, benzene, cobalt, ethylbenzene, lead, manganese, naphthalene, nickel, silver, sodium, toluene, xylenes (total), and zinc [98, pp. 7-9; 100, pp. 5, 6; 101, pp. 9, 14, 16; 102, pp. 6, 10, 12; 103, pp. 5-8, 10, 12].

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Ground Water Observed Release Factor Value: 550

### **3.1.2 POTENTIAL TO RELEASE**

An observed release to Aquifer 1 has been established based on chemical analysis; therefore, Potential to Release for the sources at the site need not be evaluated [1, p. 51595, Sections 3.1.1 and 3.1.2].

### 3.2 WASTE CHARACTERISTICS

#### 3.2.1 Toxicity/Mobility

The following substances are attributed to the site by the documented waste disposal history or chemical analysis. Hazardous substances attributable to the site are considered associated with all three sources at the site, as no definitive information indicates that any of the hazardous substances cannot be present in any of the sources [1, p. 51588, Section 2.2.2].

<b>Hazardous Substance</b>	<b>Source No.</b>	<b>Toxicity Factor Value</b>	<b>Mobility Factor Value</b>	<b>Toxicity/Mobility</b>	<b>Reference</b>
Arsenic	1	10,000	1	10,000	2, p. B-2
Barium	1	10,000	1	10,000	2, p. B-2
Benzene	1	100	1	100	2, p. B-2
Cobalt	1	1	1	1	2, p. B-6
Ethylbenzene	1, 2, 3	10	1	10	2, p. B-10
Lead	1	10,000	1	10,000	2, p. B-13
Manganese	1	10,000	1	10,000	2, p. B-13
Naphthalene	1	100	1	100	2, p. B-14
Nickel	1	10,000	1	10,000	2, p. B-14
Silver	1	100	1	100	2, p. B-17
Sodium	1	NL	1	--	2, p. B-18
Toluene	1, 2, 3	10	1	10	2, p. B-19
Xylenes (total)	1, 2, 3	1	1	1	2, p. B-20
Zinc	1	10	1	10	2, p. B-20

NL = Value not listed in Reference 2.

-- = Cannot be calculated due to lack of Toxicity Factor Value in Reference 2.

Value for o-xylenes used for xylenes (total): yields lowest Toxicity/Mobility Factor Value

For any hazardous substance that meets the criteria of an observed release by chemical analysis to an aquifer, a Mobility Factor Value of 1 is assigned [1, p. 51601, Section 3.2.1.2]. For the purposes of calculating the Hazardous Waste Quantity Factor Value, the highest Toxicity/Mobility Factor Value of 10,000 (arsenic, barium, lead, manganese, and nickel) will be used [1, p. 51602, Section 3.2.1.3; 2, pp. B-2, B-13, B-14].

=====

Toxicity/Mobility Factor Value: 10,000

### 3.2.2 Hazardous Waste Quantity

Source Number	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is source hazardous constituent quantity data complete? (Yes/No)
1	760	No
2	6	No
3	0.35	No

Sum of Values: 766.35

The sum of the source Hazardous Waste Quantity values for Sources 1, 2, and 3 is 766.35, which is assigned a Hazardous Waste Quantity Factor value of 100 [1, p. 51591, Table 2-6].

### 3.2.3 Waste Characteristics Factor Category Value

The Waste Characteristics Product Value is obtained by multiplying the Hazardous Waste Quantity Value by the Toxicity/Mobility Factor Value [1, p. 51592, Section 2.4.3.1].

$$\text{Hazardous Waste Quantity Factor Value (100)} \times \text{Toxicity/Mobility Factor Value (10,000)} = 1 \times 10^6$$

From Table 2-7, a Waste Characteristics Product Value of  $1 \times 10^6$  is assigned a Waste Characteristics Factor Category Value of 32 [1, p. 51592, Table 2-7].

=====

Hazardous Waste Quantity Factor Value: 100  
Waste Characteristics Factor Category Value: 32

### 3.3 TARGETS

#### Public Water Supplies

Eleven public drinking water wells, all of which obtain water from the interconnected overburden/bedrock aquifer (Aquifer 1), are located within the ground water target distance limit for the site [42, pp. 1-3; 43; 49; 51; 52; 57; 89, pp. 1-5; 96, pp. 1-3]. Contamination has not been documented in any drinking water well; therefore, the nearest well and population targets are evaluated as subject to potential contamination.

<b>Well</b>	<b>Distance From Source (miles)</b>	<b>Aquifer</b>	<b>Level I Contam. (Yes/No)</b>	<b>Level II Contam. (Yes/No)</b>	<b>Potential Contam. (Yes/No)</b>	<b>References</b>
WWD Browns Crossing Tubular Wellfield	1.6	1	No	No	Yes	37; 38; 96, pp. 2, 3
WWD Barros Tubular Wellfield	2.1	1	No	No	Yes	37; 38; 96, pp. 2, 3
WWD Salem Street Well	2.2	1	No	No	Yes	37; 38; 96, pp. 2, 3
RWD Well No. 66-8	3.4	1	No	No	Yes	85, p. 01; 96, pp. 1, 3
RWD Well No. 13	3.5	1	No	No	Yes	85, p. 01; 96, pp. 1, 3
RWD Well No. 15	3.6	1	No	No	Yes	85, p. 01; 96, pp. 1, 3
RWD Town Forest Well	3.6	1	No	No	Yes	85, p. 01; 96, pp. 1, 3
RWD B-line Well	3.6	1	No	No	Yes	85, p. 01; 96, pp. 1, 3
RWD Well No. 2	3.7	1	No	No	Yes	85, p. 01; 96, pp. 1, 3
RWD Well No. 3	3.8	1	No	No	Yes	85, p. 01; 96, pp. 1, 3
WWD Town Park Well	3.9	1	No	No	Yes	37; 38; 96, pp. 2, 3

WWD = Wilmington Water Department

RWD = Reading Water Department

#### Private Drinking Water Wells

The number and distribution of private drinking water wells located within 4 radial miles of the site were estimated using U.S. Census Bureau 1990 STF-3A files [47, p. 1]. The boundary line coordinates of the Block Groups were extracted from U.S. Census Bureau 1990 Tiger/Line files [47, p. 1]. Block Group populations within partial blocks are calculated based on the percentage area of the block within the target distance ring [47, p. 2]. The locations of private wells were estimated with target distance rings located 0.25, 0.5, 1, 2, 3, and 4 radial miles from the site [47, p. 1]. The population served by “drilled wells” and “dug wells” was summed to estimate the population which relies on drinking water from private drinking water wells located in each target distance ring [47, pp. 11, 12].

### 3.3.1 Nearest Well

The nearest drinking water well to sources at the site is the private drinking water well that serves the residence located at 1069 South Street [3, p. 148; 46, p. 1, Sheet 1]. This private drinking water well is located within 700 feet of Sources 1, 2, and 3 [3, p. 148; 7, p. 23].

Level of Contamination (I, II, or potential): Potential

If potential contamination, distance from source in miles: 0.1 miles

For a nearest well located from 0 to ¼ miles from a sources at a site, the Nearest Well Factor is assigned a value of 20 [1, p. 51603, Table 3-11].

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Nearest Well Factor Value: 20

### 3.3.2 Population

#### 3.3.2.1 Level of Contamination

#### 3.3.2.2 Level I Concentrations

No ground water population targets subject to Level I contamination were identified within the target distance limits.

#### 3.3.2.3 Level II Concentrations

No ground water population targets subject to Level II contamination were identified within the target distance limits.

### 3.3.2.4 Potential Contamination

The number of people served by drinking water from points of withdrawal subject to potential contamination is estimated below [42, pp. 1-3; 43; 47, pp. 11-12; 49; 51; 52; 57; 89, pp. 1-5; 96, p. 1-3]. The number of people present within each distance category is rounded to the nearest integer [1, p. 51604, Table 3-12].

Distance Category	Well ID	Well Service Population	Total Groundwater Population	References
0 to ¼	Private Wells	3	3	47, p. 12
> ¼ to ½	Private Wells	8	8	47, p. 12
> ½ to 1	Private Wells	24	24	47, p. 11
> 1 to 2	WWD Browns Crossing Tubular Wellfield	2,155	2,245	37; 38; 90, p. 41; 96, pp. 2, 3
	Private Wells	90		47, p. 11
> 2 to 3	WWD Barros Tubular Wellfield	2,155	4,524	37; 38; 90, p. 41; 96, pp. 2, 3
	WWD Salem Street Well	2,155		37; 38; 90, p. 41; 96, pp. 2, 3
	Private Wells	214		47, p. 11
> 3 to 4	RWD Well No. 66-8	3,000	23,404	84; 85, pp. 01, 02; 96, pp. 1, 3
	RWD Well No. 13	3,000		84; 85, pp. 01, 02; 96, pp. 1, 3
	RWD Well No. 15	3,000		84; 85, pp. 01, 02; 96, pp. 1, 3
	RWD Town Forest Well	3,000		84; 85, pp. 01, 02; 96, pp. 1, 3
	RWD B-line Well	3,000		84; 85, pp. 01, 02; 96, pp. 1, 3
	RWD Well No. 2	3,000		84; 85, pp. 01, 02; 96, pp. 1, 3
	RWD Well No. 3	3,000		84; 85, pp. 01, 02; 96, pp. 1, 3
	WWD Town Park Well	2,155		37; 38; 90, p. 41; 96, pp. 2, 3
	Private Wells	249		47, p. 11

WWD = Wilmington Water Department

RWD = Reading Water Department

## GW - Potential Contamination

The bedrock in the vicinity of the site is not composed of limestone or dolomite, and is therefore, not classified as karst [7, pp. 31, 32, 40; 72, p. 513]. Therefore, the “Other than Karst” Distance-Weighted Population values are used to calculate the Potential Contamination Factor Value [1, p. 51604, Section 3.3.2.4]. The number of people present within each distance category is rounded to the nearest integer [1, p. 51604, Table 3-12].

<b>Distance Category</b>	<b>Population</b>	<b>Distance-Weighted Population Value</b>	<b>Reference</b>
≥ 0 to ¼	3	4	1, p. 51604, Table 3-12; 47, p. 12
> ¼ to ½	8	2	1, p. 51604, Table 3-12; 47, p. 12
> ½ to 1	24	5	1, p. 51604, Table 3-12; 47, p. 11
> 1 to 2	2,244	294	1, p. 51604, Table 3-12; 37; 38; 47, p. 11; 90, p. 41; 96, pp. 1-3
> 2 to 3	4,523	678	1, p. 51604, Table 3-12; 37; 38; 47, p. 11; 90, p. 41; 96, pp. 2, 3
> 3 to 4	23,403	1,306	1, p. 51604, Table 3-12; 37; 38; 47, pp. 11; 84; 85, pp. 01, 02; 90, p. 41; 96, pp. 1-3

Sum of Distance-Weighted Population Values: 2,289

The sum of the Distance-Weighted Population Value is divided by 10 to determine the Potential Contamination Factor Value. If the Potential Contamination Factor Value is greater than 1, the value is rounded to the nearest integer [1, p. 51604, Table 3-12].

Potential Contamination Factor Value  $(2,289) \div 10 = 228.9$ , rounded to nearest integer is 229.

=====

Potential Contamination Factor Value: 229

### 3.3.3 RESOURCES

The Krochmal Farm property, located directly north of the site, maintains a private well which supplies water for livestock and crops [3, p. 148]. It is unknown whether the irrigation of commercial food crops use of the Krochmal Farm well water applies to at least 5 acres [3, p. 148]. Therefore, the documented resource use of the Krochmal Farm Well is limited to the watering of commercial livestock [1, p. 51604, Section 3.3.3].

Well	Aquifer	Resource Use	Reference
Krochmal Farm Well	1	watering of commercial livestock	3, p. 148

A Resources value of 5 is assigned to the aquifer due to the use of the aforementioned private well for watering of commercial livestock [1, p. 51604, Section 3.3.3].

=====

Resources Factor Value: 5

### 3.3.4 WELLHEAD PROTECTION AREA

The 100 Acre Wellfield comprises the MA DEP Zone II wellhead protection areas for the Reading Water Department wells designated Nos. 2, 3, 13, 15, 66-8, the B-Line Well, and the Town Forest Well [85, p. 01]. The 100 Acre Wellfield does not extend to Sources 1, 2, or 3 (which each have a Containment Factor Value of 10) [85, p. 01]. Observed ground water contamination attributable to the sources at the site does not lie, partially or fully, within the MA DEP Zone II wellhead protection areas for the wells [85, p. 01]. However, MA DEP Zone II wellhead protection areas for the aforementioned Reading Water Department wells are located within 4 miles of the site [96, p. 3]. MA DEP Zone II wellhead protection area regulations were written in accordance with the requirements of the Safe Drinking Water Act [6]. Therefore, a Wellhead Protection Area Factor Value of 5 is assigned to Aquifer 1 [1, p. 51604, Section 3.3.4; 85, pp. 01, 02].

Area	Use	Value	Reference
100 Acre Wellfield	Zone II wellhead protection area for RWD Well No. 2	5	85, pp. 01, 02
100 Acre Wellfield	Zone II wellhead protection area for RWD Well No. 3	5	85, pp. 01, 02
100 Acre Wellfield	Zone II wellhead protection area for RWD Well No. 13	5	85, pp. 01, 02
100 Acre Wellfield	Zone II wellhead protection area for RWD Well No. 15	5	85, pp. 01, 02
100 Acre Wellfield	Zone II wellhead protection area for RWD Well No. 66-8	5	85, pp. 01, 02
100 Acre Wellfield	Zone II wellhead protection area for RWD B-Line Well	5	85, pp. 01, 02
100 Acre Wellfield	Zone II wellhead protection area for RWD Town Forest Well	5	85, pp. 01, 02

RWD = Reading Water Department

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Wellhead Protection Area Factor Value: 5

## 4.0 SURFACE WATER PATHWAY

### 4.1 OVERLAND/FLOOD MIGRATION COMPONENT

#### 4.1.1.1 DEFINITION OF HAZARDOUS SUBSTANCE MIGRATION PATH FOR OVERLAND/FLOOD COMPONENT

Site topography is dominated by two lobes of the Landfill source (Source 1), which are surrounded by smaller hills and wetlands [7, p. 33]. The northern and southern landfill lobes are separated by Sutton Brook and associated wetlands, which surround the landfill lobes [7, p. 33]. Site elevation ranges from 77 to 173 feet above sea level [7, p. 33]. The site is drained by two branches of Sutton Brook, an eastern and a southern branch [7, p. 42; 8]. The eastern branch of Sutton Brook flows east to west between the northern landfill lobe and the southern landfill lobe and drains the majority of the site [7, p. 42; 8]. The southern branch of Sutton Brook enters the site near the southern site boundary (flowing south to north) and merges with the eastern branch of Sutton Brook downstream of Sources 1, 2, and 3 [7, p. 42; 8]. Portions of the site lie within the 100-year floodplain for Sutton Brook [48].

Runoff from the sources at the site generally drains radially toward the wetlands which surround the site, entering the wetlands at multiple probable points of entry (PPEs) which then discharge to the eastern and southern branches of Sutton Brook [7, p. vi; 8]. The most upstream PPE is located along Sutton Brook, downgradient of observed leachate seeps on the eastern toe of the northern lobe of Source 1 (see Figure 8 in Attachment A of this document) [3, pp. 10, 11]. The most downstream PPE to surface water is located southwest of the western edge of Source 2 (see Figure 8 in Attachment A of this document) [8]. From the most downstream PPE to surface water, the surface water pathway continues approximately 0.8 miles downstream along Sutton Brook to its confluence with the Shawsheen River [88]. The surface water pathway continues 9.3 miles downstream along the Shawsheen River to its confluence with the Merrimack River [88]. The surface water pathway continues an additional 4.9 miles along the Merrimack River until its terminus, located approximately 0.5 miles downstream of the Interstate Route 495 bridge, in Haverhill, Massachusetts (see Figure 7 in Attachment A of this document) [88].

There are no U.S. Geological Survey (USGS) gauging stations along Sutton Brook; therefore, the mean annual flow rate of Sutton Brook was estimated to be 4.95 cubic feet per second (cfs) based on its measured upstream drainage basin area [55, pp. 1-3; 59, p. vii]. Based on its estimated mean annual flow rate, Sutton Brook is considered a minimal stream with a mean annual flow rate of  $\leq 10$  cfs [1, p. 51613, Table 4-13; 55, p. 1 of 3].

There are no USGS gauging stations along the Shawsheen River downstream of its confluence with Sutton Brook; therefore, the mean annual flow rate of the Shawsheen River at its confluence with Sutton Brook was estimated to be 105.23 cfs based on its measured upstream drainage basin area [54, p. 2 of 4; 59, pp. vii, xii, xv, 80]. Based on its estimated mean annual flow rate, the Shawsheen River, at its confluence with Sutton Brook, is considered a moderate to large stream with a mean annual flow rate between 100 and 1,000 cfs [1, p. 51613, Table 4-13; 54, p. 2 of 4]. At its mouth at the Merrimack River, the estimated mean annual flow rate of the Shawsheen River is 140.44 cfs, based on its measured upstream drainage basin area [54, p. 2 of 4]. Based on its estimated mean annual flow rate, the Shawsheen River, from its confluence with Sutton Brook to its mouth at the Merrimack River, is considered a moderate to large stream with a mean annual flow rate between 100 and 1,000 cfs [1, p. 51613, Table 4-13; 54, p. 2 of 4].

USGS gauging station No. 01100000 is located along the Merrimack River approximately 1,100 feet downstream of its confluence with the Concord River [59, p. 70]. At USGS gauging station No. 01100000, the drainage basin of the Merrimack River is approximately 4,425 mi<sup>2</sup> and the measured mean annual flow rate is 7,708 cfs [59, p. 70]. There are no additional USGS gauging stations along the Merrimack River with streamflow data downstream of this station [59, pp. vii, xii, xv]. The mean annual flow rate of the Merrimack River at its confluence with the Shawsheen River has, therefore been estimated to be 8,063 cfs, based on its measured drainage basin area [105; 107]. The mean annual flow rate of the Merrimack River at its mouth, downstream of the surface water pathway terminus, was estimated to be 8,373 cfs [105; 107]. Based on its estimated mean annual flow rate, the Merrimack River, from its confluence with the Shawsheen River to its mouth, is considered a large stream to river, with a mean annual flow rate between 1,000 and 10,000 cfs [1, p. 51613, Table 4-13; 105].

#### 4.1.2.1 LIKELIHOOD OF RELEASE

##### 4.1.2.1.1 Observed Release

###### Chemical Analysis

###### Background Samples (Surface Water/Sediment)

EPA START collected surface water and sediment samples from Sutton Brook and points downstream between 9 August 1999 and 10 August 1999 [3, pp. 64-87]. Sampling activities were conducted in accordance with the EPA New England approved Task Work Plan dated 6 July 1999 and approved 13 July 1999 [3, pp. 64-87; 76]. The surface water samples were analyzed through EPA CLP laboratories for VOCs, SVOCs, pesticide/PCB compounds, inorganic elements, and cyanide by standard EPA methods [78, Attachment A, p. 02; 79, Attachment A, p. 01]. The sediment samples were analyzed through DAS laboratories for VOCs, SVOCs, pesticide/PCB compounds, inorganic elements and cyanide by standard EPA methods [113, Attachment A, pp. 1, 2; 114, Attachment A, p. 1]. The data were validated according to EPA New England Tier II requirements [78, p. 1; 79, p. 1; 113, p. 1; 114, p. 1].

Surface water sample SW-11 was collected on 10 August 1999 and sediment samples SD-06, SD-16, and SD-17 were collected on 9 August 1999 by EPA START from Sutton Brook and associated wetlands at locations upstream of the most upstream PPE to surface water from the site (see Figure 8 in Attachment A of this document) [3, pp. 68, 69, 75, 76, 83, 84]. Surface water sample SW-11 and sediment samples SD-06, SD-16, and SD-17 were selected as background samples due to their locations upstream of the sources [3, pp. 68, 69, 75, 76, 83, 84]. The background samples were used to establish background conditions in the media of concern (surface water or sediment) and the non-ubiquity of VOCs, SVOCs, and inorganic elements in the environment [78, p. 8; 79, p. 8; 113, pp. 7, 10; 114, p. 7, 10]. Three VOCs (ethylbenzene, toluene, and xylenes (total)) detected in the on-site surface water samples and in source samples will be utilized to evaluate the surface water pathway [78, pp. 8, 9; 79, p. 8]. Additionally, seven SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and naphthalene) and one inorganic element (chromium) detected in the on-site sediment samples and in source samples, will also be utilized to evaluate the surface water pathway [113, pp. 7, 10, 11; 114, pp. 7, 10].

###### Background Concentrations (Surface Water/Sediment)

Sample ID	Sampling Location	Depth	Date	Reference
SW-11	Sutton Brook	Surface	10 August 1999	3, pp. 83, 84
SD-06	Sutton Brook	0 to 6 inches	9 August 1999	3, pp. 75, 76
SD-16	South branch of Sutton Brook	0 to 6 inches	9 August 1999	3, pp. 68, 69
SD-17	South branch of Sutton Brook	0 to 6 inches	9 August 1999	3, p. 69

Background sediment sample SD-06 consisted of brown silt with trace organics [3, pp. 75, 76]. Background sediment sample SD-16 consisted of brown to black silt and fine to coarse sand [3, p. 68]. Background sediment sample SD-17 consisted of black to brown fine to medium sand and organics [3, p. 69]. Sediment sample SD-03 consisted of brown fine sand and clay with little organics and medium to coarse gravel [3, p. 74]. Sediment sample SD-04 consisted of dark brown clay and fine sand [3, p. 75]. Although the sample matrix for sediment background sample SD-16 best matches both the sample matrices for contaminated sediment samples collected downstream along the wetlands of Sutton Brook (SD-03 and SD-04), the highest background concentrations from all the background sediment samples are used for comparison [3, pp. 68, 69].

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit	Reference
SW-11	Arsenic	ND	10 µg/L	79, pp. 7, 8
	Ethylbenzene	ND	10 µg/L	78, pp. 7, 8
	Toluene	ND	10 µg/L	78, pp. 7, 8
	Xylenes (total)	ND	10 µg/L	78, pp. 7, 8
SD-06	Benzo(a)anthracene	ND	660 µg/kg	113, pp. 7, 10
	Benzo(a)pyrene	ND	660 µg/kg	113, pp. 7, 10
	Benzo(g,h,i)perylene	ND	660 µg/kg	113, pp. 7, 10
	Chromium	18.9 mg/kg	3.0 mg/kg	114, pp. 7, 10
	Chrysene	ND	660 µg/kg	113, pp. 7, 10
	Fluoranthene	ND	660 µg/kg	113, pp. 7, 10
	Indeno(1,2,3-cd)pyrene	ND	660 µg/kg	113, pp. 7, 10
	Naphthalene	ND	660 µg/kg	113, pp. 7, 10
SD-16	Benzo(a)anthracene	ND	590 µg/kg	113, pp. 7, 10
	Benzo(a)pyrene	ND	590 µg/kg	113, pp. 7, 10
	Benzo(g,h,i)perylene	ND	590 µg/kg	113, pp. 7, 10
	Chromium	8.6 mg/kg	3.0 mg/kg	114, pp. 7, 10
	Chrysene	ND	590 µg/kg	113, pp. 7, 10
	Fluoranthene	ND	590 µg/kg	113, pp. 7, 10
	Indeno(1,2,3-cd)pyrene	ND	590 µg/kg	113, pp. 7, 10
	Naphthalene	ND	590 µg/kg	113, pp. 7, 10
SD-17 (Metals only)	Chromium	5.5	2.9 mg/kg	114, pp. 7, 10

ND = Not detected.

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

## Contaminated Samples (Surface Water)

EPA START collected surface water samples from Sutton Brook and points downstream between 9 August 1999 and 10 August 1999 [3, pp. 64-87]. Surface water samples SW-02, SW-03, SW-05, SW-06, and SW-08 were collected by EPA START in accordance with the EPA New England approved Task Work Plan dated 6 July 1999 and approved 13 July 1999 [3, pp. 64 -87; 76]. The surface water samples were analyzed through CLP laboratories for VOCs, SVOCs, pesticide/PCB compounds, inorganic elements, and cyanide by standard EPA methods. The data were validated according to EPA New England Tier II requirements [78, p. 1; 79, p. 1].

Each surface water sample is considered to document an observed release if a hazardous substance was detected in the sample at three times or greater than the background sample concentration (SW-11), or, if the hazardous substance was not detected in the background sample, greater than or equal to the background sample's SQL (for organic compounds) or SDL (for inorganic elements) for that hazardous substance [1, p. 51609, Section 2.3]. Three VOCs (ethylbenzene, toluene, and xylenes (total)) and one inorganic element (arsenic) detected in surface water samples will be used to document an observed release to the surface water pathway [78, pp. 8, 9; 79, p. 8].

Sample ID	Sampling Location	Depth	Date	Reference
SW-02	Sutton Brook	Surface	9 August 1999	3, pp. 66, 67; 76
SW-03	Sutton Brook	Surface	9 August 1999	3, pp. 67, 68; 76
SW-05	Sutton Brook	Surface	10 August 1999	3, pp. 79, 80; 76
SW-06 (Duplicate of SW-05)	Sutton Brook	Surface	10 August 1999	3, pp. 79, 80; 76
SW-08	Sutton Brook	Surface	9 August 1999	3, pp. 69, 70; 76

The following analytical results document the presence of arsenic, ethylbenzene, toluene, and xylenes (total) in Sutton Brook downstream of the PPEs to surface water from the site.

Sample ID	Hazardous Substance	Concentration	Sample Quantitation Limit or Sample Detection Limit	Reference
SW-02	Arsenic	33.8 $\mu\text{g/L}$	10 $\mu\text{g/L}$	79, pp. 6, 8
SW-03	Arsenic	131 $\mu\text{g/L}$	10 $\mu\text{g/L}$	79, pp. 6, 8
	Toluene	14 $\mu\text{g/L}$	10 $\mu\text{g/L}$	78, pp. 6, 8
SW-05	Arsenic	147 $\mu\text{g/L}$	10 $\mu\text{g/L}$	79, pp. 6, 9
	Ethylbenzene	12 $\mu\text{g/L}$	10 $\mu\text{g/L}$	78, pp. 6, 8
	Toluene	78 $\mu\text{g/L}$	10 $\mu\text{g/L}$	78, pp. 6, 8
	Xylenes (total)	37 $\mu\text{g/L}$	10 $\mu\text{g/L}$	78, pp. 6, 8
SW-06 (Duplicate of SW-05)	Arsenic	136 $\mu\text{g/L}$	10 $\mu\text{g/L}$	79, pp. 6, 9
	Toluene	88 $\mu\text{g/L}$	10 $\mu\text{g/L}$	78, pp. 6, 8
	Xylenes (total)	36 $\mu\text{g/L}$	10 $\mu\text{g/L}$	78, pp. 6, 8
SW-08	Arsenic	77.7 $\mu\text{g/L}$	10 $\mu\text{g/L}$	79, pp. 6, 9
	Toluene	72 $\mu\text{g/L}$	10 $\mu\text{g/L}$	78, pp. 7, 8
	Xylenes (total)	33 $\mu\text{g/L}$	10 $\mu\text{g/L}$	78, pp. 7, 8

$\mu\text{g/L}$  = micrograms per liter.

## Contaminated Samples (Sediment)

EPA START collected sediment samples (including one duplicate sample and one background sample) from Sutton Brook, associated wetlands, and points downstream between 9 August 1999 and 10 August 1999 [3, pp. 64-87]. Sediment samples SD-03 and SD-04 were collected by EPA START in accordance with the EPA New England approved Task Work Plan dated 6 July 1999 and approved 13 July 1999 [3, pp. 64-87; 76]. The sediment samples were analyzed through DAS laboratories for VOCs, SVOCs, pesticide/PCB compounds, inorganic elements, and cyanide by standard EPA methods [113, Attachment A, pp. 1, 2; 114, Attachment A, p. 1]. The data were validated according to EPA New England Tier II requirements [113, p. 1; 114, p. 1]. Sediment samples SD-03 and SD-04 were collected at depths of 0 to 6 inches below ground surface [3, pp. 74, 75].

Each sediment sample is considered to document an observed release if a hazardous substance was detected in the sample at three times or greater than the highest background sample concentration (SD-06, SD-16, and SD-17), or, if the hazardous substance was not detected in the background sample, greater than or equal to the background samples' highest SQL (for organic compounds) or SDL (for inorganic elements) for that hazardous substance [1, p. 51609, Section 2.3]. Seven SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and naphthalene) and one inorganic element (chromium) detected in sediment samples will be used to document an observed release to the surface water pathway [113, pp. 7, 10, 11; 114, pp. 7, 10].

Sample ID	Sampling Location	Depth	Date	Reference
SD-03	Sutton Brook wetlands	0 to 6 inches	9 August 1999	3, p. 74; 76
SD-04	Sutton Brook wetlands	0 to 6 inches	9 August 1999	3, p. 75; 76

The following analytical results document the presence of benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chromium, chrysene, fluoranthene, and indeno(1,2,3-cd)pyrene in Sutton Brook wetlands downstream of the PPEs to surface water from the site.

<b>Sample ID</b>	<b>Hazardous Substance</b>	<b>Concentration</b>	<b>Sample Quantitation Limit or Sample Detection Limit</b>	<b>Reference</b>
SD-03	Fluoranthene	760 $\mu\text{g/kg}$	400 $\mu\text{g/kg}$	113, pp. 7, 11
SD-04	Benzo(a)anthracene	820 $\mu\text{g/kg}$	590 $\mu\text{g/kg}$	113, pp. 7, 11
	Benzo(a)pyrene	900 $\mu\text{g/kg}$	590 $\mu\text{g/kg}$	113, pp. 7, 11
	Benzo(g,h,i)perylene	660 $\mu\text{g/kg}$	590 $\mu\text{g/kg}$	113, pp. 7, 11
	Chromium	84.5 mg/kg	3.0 mg/kg	114, pp. 7, 10
	Chrysene	840 $\mu\text{g/kg}$	590 $\mu\text{g/kg}$	113, pp. 7, 11
	Fluoranthene	1,500 $\mu\text{g/kg}$	590 $\mu\text{g/kg}$	113, pp. 7, 11
	Indeno(1,2,3-cd)pyrene	800 $\mu\text{g/kg}$	590 $\mu\text{g/kg}$	113, pp. 7, 11
	Naphthalene	860 $\mu\text{g/kg}$	590 $\mu\text{g/kg}$	113, pp. 7, 11

$\mu\text{g/kg}$  = micrograms per kilogram.

mg/kg = milligrams per kilogram.

Attribution:

Attribution of hazardous substances in the surface water at the site is based on historical information and chemical analysis. Historically, wastes received by Rocco's Landfill included solvents, sanitary sewage sludge (containing small quantities of hazardous waste), paint sludges, and steel drum reconditioning waste [7, p. 5]. Historical information indicates that unknown quantities of municipal, commercial, and industrial wastes were disposed of in the Landfill (Source 1) and included paint sludges containing benzene, ethanol, ethyl acetate, methanol, methylene chloride, naphtha, polyvinyl acetate, toluene, turpentine, and aluminum [7, p. 5; 26, p. 17]. Dumping of scrap metal, construction debris, asphalt, and petroleum-contaminated sludges reportedly continued on the property through 1988 [7, p. 5].

On 26 October 1989, EPA contractors collected 13 shallow soil samples from Source 1 [9, p. 10]. The shallow soil samples were analyzed for Superfund List organic compounds and inorganic elements through EPA CLP [9, p. 10; 33, p. 1; 34, p. 1]. The equivalent of an EPA New England Tier II validation was performed on the data [33, p. 1; 34, p. 1]. VOCs, SVOCs, and inorganic elements were detected in Source 1 at concentrations significantly greater than background criteria [33, pp. 7-9, 13-18; 34, pp. 7, 8, 10-13]. The hazardous substances detected in Source 1 included barium, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chromium, chrysene, copper, ethylbenzene, fluoranthene, indeno(1,2,3-cd)pyrene, lead, manganese, naphthalene, nickel, vanadium, xylenes (total), and zinc [33, pp. 7-9, 13-18; 34, pp. 7, 8, 10-13]. It is unlikely that the 13 shallow soil samples collected by EPA contractors in 1989 completely characterize hazardous substances disposed of in the 1.9 million yd<sup>3</sup> Source 1 between 1957 and 1988 [7, pp. 4, 5, 89, Appendix E, p. 1 of 10; 9, p. 10]. Therefore, the additional hazardous substance which meets observed release criteria in surface water samples collected downstream of Source 1, although not detected in the shallow soil samples collected from Source 1 (arsenic), is considered associated with Source 1, as no definitive information indicates that the hazardous substance could not be present in the source [1, p. 51588, Section 2.2.2].

A drum sludge sample was collected from Source 2 by MA DEP personnel on 8 June 1999 [31, pp. 05, 10; 56, Table 4.2-a]. The drum sludge sample was submitted to a private laboratory for VOC analysis by standard EPA methods [108, pp. 1, 2]. Analytical results of the drum sludge sample collected by MA DEP personnel indicated the presence of ethylbenzene, toluene, and xylenes (total) [108, pp. 1, 2].

Soil samples were collected from Source 3 via a direct-push device by EPA START personnel from 26 July 1999 through 10 August 1999 [35, pp. 4, 5; 83, pp. 1-12, Appendix N (Table G)]. The soil samples were submitted to EPA's NERL for VOC analysis by standard EPA methods [109, Attachment A, p. 1; 110, Attachment A, p. 1; 111, Attachment A, p. 1; 112, Attachment A, p. 1]. An EPA New England Tier II validation was performed on the confirmatory soil sample analytical results [109, p. 1; 110, p. 1; 111, p. 1; 112, p. 1]. The six soil samples contained one or more of the following hazardous substances: ethylbenzene, toluene, and xylenes (total) [109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6].

Surface water samples collected downstream of the site have the greatest concentrations of hazardous substances near the PPEs to surface water from the site, and show a gradual decrease in concentration of hazardous substances with increasing downstream distance from the site (see Figure 8 in Attachment A of this document) [3, pp. 64-87; 76, pp. 4, 13; 78, pp. 6-8; 79, pp. 6-9]. Sediment samples closest to the PPEs to surface water at the site also document an observed release of hazardous substances associated with the sources at the site [113, pp. 7, 10, 11; 114, pp. 7, 10].

The substances found in the observed release are documented both by chemical analysis of source samples and in one particular case, by records of waste disposal [7, p. 5; 108, pp. 1, 2; 109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6]. Of the four hazardous substances which meet observed release criteria in downstream surface water samples, one (toluene) is a known constituent of waste disposed of in Source 1 [7, p. 5]. Three of the four hazardous substances which meet observed release criteria in downstream surface water samples (ethylbenzene, toluene, and xylenes (total)) and eight hazardous substances which meet observed release criteria in downstream sediment samples (benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chromium, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and naphthalene) were also detected in source samples collected by EPA contractors, MA DEP, or EPA START

personnel from sources at the site [33, pp. 7, 9, 13-18; 34, pp. 7, 8, 10-13; 78, pp. 6-8; 79, pp. 6-9; 108, pp. 1, 2; 109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6; 113, pp. 7, 10, 11; 114, pp. 7, 10]. Additionally, ethylbenzene, toluene, and xylenes (total) are not ubiquitous in the Tewksbury area; therefore, their presence at elevated concentrations in sources at the site and observed releases to the surface water pathway, as evidenced by surface water in Sutton Brook downstream of the sources, support at least partial attribution of these hazardous substances to the site [33, pp. 15, 16; 34, pp. 8, 10]. Arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chromium, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and naphthalene meet observed release criteria to the surface water pathway and are therefore, partially attributable to the site [1, p. 51588, Section 2.2.2]. Additionally, based on the lack of organic compounds and the presence of inorganic elements at naturally-occurring trace levels in the background surface water and sediment samples, there does not appear to be any additional sources contributing to the observed release to surface water from the site [33, pp. 7, 9, 13-18; 34, pp. 7, 8, 10-13; 78, pp. 6-8; 79, pp. 6-9; 108, pp. 1, 2; 109, pp. 5, 6; 110, pp. 5, 6; 111, pp. 5, 6; 112, pp. 5, 6; 113, pp. 7, 10, 11; 114, pp. 7, 10].

#### Hazardous Substances Released:

The following hazardous substances have been released to surface water from sources at the site: arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chromium, chrysene, ethylbenzene, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, toluene, and xylenes (total) [78, pp. 6-8; 79, pp. 6-9; 113, pp. 7, 10, 11; 114, pp. 7, 10].

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Observed Release Factor Value: 550

#### **4.1.2.1.2 POTENTIAL TO RELEASE**

Because observed release to Sutton Brook from the site is established based on chemical analysis, Potential to Release was not evaluated [1, p. 51609, Section 4.1.2.1.2].

#### 4.1.3.2 WASTE CHARACTERISTICS

##### 4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

The following substances are attributed to the site by the documented waste disposal history or chemical analysis. Hazardous substances attributable to the site are considered associated with all three sources at the site, as no definitive information indicates that any of the hazardous substances cannot be present in any of the sources [1, p. 51588, Section 2.2.2]. The Toxicity Factor Value, the Persistence Factor Value, and the Bioaccumulation Factor Value are assigned to the hazardous substances associated with the sources and releases at the site based on the values presented in SCDM [2].

Hazardous Substance	Source	Toxicity Factor Value	Persistence Factor Value	Bioaccumulation Value	Toxicity/ Persistence/ Bioaccumulation Factor Value (Table 4-16)	Reference
Arsenic	1	10,000	1	5	50,000	2, p. B-2
Benzo(a)anthracene	1	1,000	1	50,000	$5 \times 10^7$	2, p. B-2
Benzo(a)pyrene	1	10,000	1	50,000	$5 \times 10^8$	2, p. B-2
Benzo(g,h,i)perylene	1	NL	1	50,000	- -	2, p. B-3
Chromium	1	10,000	1	5	50,000	2, p. B-5
Chrysene	1	10	1	500	5,000	2, p. B-5
Ethylbenzene	1, 2, 3	10	0.4	50	200	2, p. B-10
Fluoranthene	1	100	1	5,000	$5 \times 10^5$	2, p. B-10
Indeno(1,2,3-cd)pyrene	1	1,000	1	50,000	$5 \times 10^7$	2, p. B-12
Naphthalene	1	100	0.4	500	20,000	2, p. B-14
Toluene	1, 2, 3	10	0.4	50	200	2, p. B-19
Xylenes (total)	1, 2, 3	1	0.4	50	20	2, p. B-20

NL = Value not listed in Reference 2.

- - = Cannot be calculated due to lack of Toxicity Value in Reference 2.

Value for o-xylenes used for xylenes (total): yields lowest Toxicity/Persistence/Bioaccumulation Factor Value

A Toxicity Factor Value of 10,000 and a Persistence Factor Value of 1 are assigned a Toxicity/Persistence Factor Value of 10,000 [1, p. 51613, Table 4-12]. A Toxicity/Persistence Factor Value of 10,000 and a Bioaccumulation Potential Factor Value of 50,000 are assigned a Toxicity/Persistence/Bioaccumulation Factor Value of  $5 \times 10^8$  [1, pp. 51618, 51619, Table 4-16]. The hazardous substance with the highest Toxicity/Persistence/Bioaccumulation Factor Value (benzo(a)pyrene) was used to assign the Toxicity/Persistence/Bioaccumulation Factor Value for the watershed [1, p. 51618, Section 4.1.3.2.1.4].

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Toxicity/Persistence/Bioaccumulation Factor Value:  $5 \times 10^8$

**4.1.3.2.2 Hazardous Waste Quantity**

Source Number	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is source hazardous constituent quantity data complete? (Yes/No)
1	760	No
2	6	No
3	0.35	No

Sum of values: 766.35

Based on HRS Section 2.4.2.2, if the Hazardous Constituent Quantity is not adequately determined for one or more sources and if any target for the surface water pathway is subject to Level I or Level II concentrations, a factor value is assigned from Table 2-6 or a value of 100, whichever is greater, as the Hazardous Waste Quantity Factor Value for that pathway [1, pp. 51591, 51592]. From HRS Table 2-6, the sum of source Hazardous Waste Quantity values of 766.35 is assigned a Hazardous Waste Quantity Factor Value of 100 [1, pp. 51591, 51592].

**4.1.3.2.3 Waste Characteristics Factor Category Value**

The Toxicity/Persistence Factor Value for benzo(a)pyrene (10,000) is multiplied by the Hazardous Waste Quantity Factor Value for the watershed (100) in order to determine the Waste Characteristics Product, subject to a maximum value of  $1 \times 10^8$  [1, p. 51620, Section 4.1.3.2.3].  $10,000 \times 100 = 1 \times 10^6$ .

Toxicity/Persistence Factor Value  $\times$  Hazardous Waste Quantity Factor Value:  $1 \times 10^6$

The product of the Toxicity/Persistence Factor Value and the Hazardous Waste Quantity Factor Value for the watershed are multiplied by the Bioaccumulation Potential Factor Value for benzo(a)pyrene (50,000), subject to a maximum value of  $1 \times 10^{12}$  [1, p. 51620, Section 4.1.3.2.3].  $1 \times 10^6 \times 50,000 = 5 \times 10^{10}$ .

(Toxicity/Persistence  $\times$  Hazardous Waste Quantity)  $\times$  Bioaccumulation Potential Factor Value:  $5 \times 10^{10}$

From HRS Table 2-7, a Waste Characteristics Product of  $5 \times 10^{10}$  is assigned a Waste Characteristics Factor Category Value of 320 [1, p. 51592].

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Hazardous Waste Quantity Assigned Value: 100  
Waste Characteristics Factor Category Value: 320

### 4.1.3.3 HUMAN FOOD CHAIN THREAT-TARGETS

#### 4.1.3.3.1 Food Chain Individual

Sutton Brook, the Shawsheen River, and the Merrimack River are considered recreational fisheries [82; 93, pp. 1, 2]. An observed release of arsenic, ethylbenzene, toluene, and xylenes (total) to surface water of Sutton Brook from the site has been established by chemical analysis from surface water samples [78, pp. 6-8; 79, pp. 6-9]. In addition, sediment samples document an observed release of fluoranthene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chromium, chrysene, indeno(1,2,3-cd)pyrene, and naphthalene [113, pp. 7 and 11; 114, pp. 7 and 10]. The above hazardous substances were present at higher concentrations in samples collected near the PPEs to surface water from the site and gradually decreased in concentrations at downstream locations [78, pp. 6-8; 79, pp. 6-9]. The distribution of the above hazardous substances along Sutton Brook adjacent to and downstream of sources at the site suggests that these substances are, at least in part, attributable to releases from the identified sources located at the site. However, the hazardous substances found in the surface water samples do not have Bioaccumulation Potential Factor Values of 500 or greater [2, pp. B-2, B-10, B-19, B-20], and although many of the hazardous substances found in the sediment samples do have a Bioaccumulation Potential Factor of 500 and greater, the sediment samples are not being considered for this purpose at this time. It is still under investigation as to whether the contaminated portions of these wetlands can be considered part of the Sutton Brook fishery. At this time, the Sutton Brook fishery is not, therefore, being evaluated as actual human food chain contamination [1, p. 51620, Section 4.1.3.3]. Therefore, the Food Chain Individual Factor Value is assigned based on the highest dilution weight applicable to fisheries within the target distance limit [1, p. 51620, Section 4.1.3.3.1]. The highest dilution weight (1) is multiplied by 20 and rounded to the nearest integer to assign the Food Chain Individual Factor Value (20) [1, p. 51620, Section 4.1.3.3.1].

Sample ID: SW-02

Hazardous Substance: Toluene, xylenes (total)

Bioaccumulation Potential: 50

Identity of Fishery	Type of Surface Water Body	Reference	Dilution Weight
Sutton Brook	Minimal Stream	1, p. 51613, Table 4-13; 55, pp. 1-3	1

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Food Chain Individual Factor Value: 20

**4.1.3.3.2 Population****4.1.3.3.2.1 Level I Concentrations**

No fishery subject to Level I actual human food chain contamination has been identified [1, p. 51620, Section 4.1.3.3; 78, pp. 6-8; 79, pp. 6-9].

<b>Identity of Fishery</b>	<b>Annual Production (pounds)</b>	<b>Human Food Chain Population Value</b>	<b>Reference</b>
NS			

Sum of Human Food Chain Population Values: NS

---

Level I Concentrations Factor Value: NS

4.1.3.3.2.2 Level II Concentrations

No fishery subject to Level II actual human food chain contamination has been identified [1, p. 51620, Section 4.1.3.3; 78, pp. 6-8; 79, pp. 6-9].

<b>Identity of Fishery</b>	<b>Annual Production (pounds)</b>	<b>Human Food Chain Population Value</b>	<b>Reference</b>
NS			

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Level II Concentrations Factor Value: NS

4.1.3.3.2.3 Potential Human Food Chain Contamination

Sutton Brook, the Shawsheen River, and the Merrimack River are considered recreational fisheries and are subject to potential human food chain contamination [1, p. 51620, Section 4.1.3.3; 82; 93, pp. 1, 2; 94, pp. 1, 2]. An observed release of arsenic, ethylbenzene, toluene, and xylenes (total) to surface water of Sutton Brook from the site has been established by chemical analysis based on surface water samples [78, pp. 6-8; 79, pp. 6-9]. In addition, sediment samples document an observed release of fluoranthene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chromium, chrysene, indeno(1,2,3-cd)pyrene, and naphthalene [113, pp. 7 and 11; 114, pp. 7 and 10]. However, the above hazardous substances found in the surface water samples do not have Bioaccumulation Potential Factor Values of 500 or greater [2, pp. B-2, B-10, B-19, B-20], and although many of the hazardous substances found in the sediment samples do have a Bioaccumulation Potential Factor of 500 and greater, the sediment samples are not being considered for this purpose at this time. The sediment samples were taken from wetlands close to Sutton Brook. It is still under investigation as to whether the contaminated portion of these wetlands can be considered part of the Sutton Brook fishery. No information regarding annual human food chain production from the Sutton Brook, the Shawsheen River, and the Merrimack River fisheries is available [82; 94, pp. 1, 2]. Therefore, Sutton Brook, Shawsheen River, and Merrimack River fisheries are assigned an annual production value of greater than 0 pounds, and assigned a Human Food Chain Population value of 0.03 [1, p. 51621, Table 4-18].

<b>Identity of Fishery</b>	<b>Annual Production (pounds)</b>	<b>Type of Surface Water Body</b>	<b>Average Annual Flow</b>	<b>References</b>	<b>Population Value (<math>P_i</math>)</b>	<b>Dilution Weight (<math>D_i</math>)</b>	<b><math>P_i \times D_i</math></b>
Sutton Brook	>0	Minimal stream	4.95 cfs	55, pp. 1-3; 82	0.03	1.0	0.03
Shawsheen River	>0	Moderate to large stream	140.44 cfs	54, pp. 1-4; 93, pp. 1, 2; 94, pp. 1, 2	0.03	0.01	0.0003
Merrimack River	>0	Large stream to river	8,373 cfs	59, pp. 1-4; 93, pp. 1, 2; 94, pp. 1, 2; 105; 107	0.03	0.001	0.00003

Sum of  $P_i \times D_i$ : 0.03033 [1, p. 51621, Section 4.1.3.3.2.3, Table 4-18]  
 (Sum of  $P_i \times D_i$ )  $\div$  10: 0.003033 [1, p. 51621, Section 4.1.3.3.2.3, Table 4-18]

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Potential Human Food Chain Contamination Factor Value: 0.003033

#### 4.1.4.2 WASTE CHARACTERISTICS

##### 4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

The following substances are attributed to the site by the documented waste disposal history or chemical analysis. Hazardous substances attributable to the site are considered associated with all three sources at the site, as no definitive information indicates that any of the hazardous substances cannot be present in any of the sources [1, p. 51588, Section 2.2.2]. The Ecosystem Toxicity Factor Value and the Persistence Factor Value are assigned to the hazardous substances associated with the sources and releases at the site based on the values presented in SCDM [2].

Hazardous Substance	Source No.	Ecosystem Toxicity Factor Value	Persistence Factor Value	Ecosystem Toxicity/Persistence Factor Value (Table 4-20)	Reference
Arsenic	1	10	1	10	2, p. B-2
Benzo(a)anthracene	1	10,000	1	10,000	2, p. B-2
Benzo(a)pyrene	1	10,000	1	10,000	2, p. B-2
Benzo(g,h,i)perylene	1	NL	1	--	2, p. B-3
Chromium	1	100	1	100	2, p. B-5
Chrysene	1	1,000	1	1,000	2, p. B-5
Ethylbenzene	1, 2, 3	100	0.4	40	2, p. B-10
Fluoranthene	1	10,000	1	10,000	2, p. B-10
Indeno(1,2,3-cd)pyrene	1	NL	1	--	2, p. B-12
Naphthalene	1	1,000	0.4	400	2, p. B-14
Toluene	1, 2, 3	100	0.4	40	2, p. B-19
Xylenes (total)	1, 2, 3	100	0.4	40	2, p. B-20

NL = Value not listed in Reference 2.

-- = Cannot be calculated due to lack of Ecosystem Toxicity Factor Value in Reference 2.

Value for o-xylenes used for xylenes (total): yields lowest Ecosystem Toxicity/Persistence Factor Value

The Ecosystem Toxicity Persistence Factor Value and the Bioaccumulation Factor Value are assigned to the hazardous substances associated with the sources and releases at the site based on the values presented in SCDM [2].

<b>Hazardous Substance</b>	<b>Ecosystem Toxicity/ Persistence Factor Value</b>	<b>Bio-accumulation Factor Value (Section 4.1.3.2.1.2)</b>	<b>Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value (Table 4-21)</b>	<b>Reference</b>
Arsenic	10	500	5,000	2, p. B-2
Benzo(a)anthracene	10,000	50,000	$5 \times 10^8$	2, p. B-2
Benzo(a)pyrene	10,000	50,000	$5 \times 10^8$	2, p. B-2
Benzo(g,h,i)perylene	- -	50,000	- -	2, p. B-3
Chromium	100	5	500	2, p. B-5
Chrysene	1,000	5,000	$5 \times 10^6$	2, p. B-5
Ethylbenzene	40	50	2,000	2, p. B-10
Fluoranthene	10,000	500	$5 \times 10^6$	2, p. B-10
Indeno(1,2,3-cd)pyrene	- -	50,000	- -	2, p. B-12
Naphthalene	400	500	$2 \times 10^5$	2, p. B-14
Toluene	40	50	2,000	2, p. B-19
Xylenes (total)	40	50	2,000	2, p. B-20

- - = Cannot be calculated due to lack of Ecosystem Toxicity Factor Value in Reference 2.

Value for o-xylenes used for xylenes (total): yields lowest Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value

From HRS Table 4-21, an Ecosystem Toxicity/Persistence Factor Value of 10,000 and a Bioaccumulation Factor Value of 50,000 are assigned an Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value of  $5 \times 10^8$  [1, pp. 51622, Section 4.1.4.2.1.4, 51623]. The hazardous substance with the highest Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value was used to assign the Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value for the watershed [1, p. 51622, Section 4.1.4.2.1.4].

=====

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value:  $5 \times 10^8$

**4.1.4.2.2. Hazardous Waste Quantity**

Source Number	Source Hazardous Waste Quantity Value (Section 2.4.2.1.5)	Is source hazardous constituent quantity data complete? (Yes/No)
1	760	No
2	6	No
3	0.35	No

Sum of values: 766.35

Based on HRS Section 2.4.2.2, if the Hazardous Constituent Quantity is not adequately determined for one or more sources and if any target for the surface water pathway is subject to Level I or Level II concentrations, a factor value is assigned from Table 2-6 or a value of 100, whichever is greater, as the Hazardous Waste Quantity Factor Value for that pathway [1, pp. 51591, 51592]. From HRS Table 2-6, the sum of source Hazardous Waste Quantity values of 766.35 is assigned an Hazardous Waste Quantity value of 100 [1, p. 51591, Section 2.4.2.2].

**4.1.4.2.3. Waste Characteristics Factor Category Value**

The Ecosystem Toxicity Factor Values for benzo(a)anthracene and benzo(a)pyrene (10,000) and the Persistence Factor Values for benzo(a)anthracene and benzo(a)pyrene (1) are multiplied in order to determine the Ecosystem Toxicity/Persistence Factor Value (10,000) [1, p. 51622, Section 4.1.4.2.1.4, Table 4-20]. The Ecosystem Toxicity/Persistence Factor Values for benzo(a)anthracene and benzo(a)pyrene (10,000) is multiplied by the Hazardous Waste Quantity Factor Value for the watershed (100) in order to determine the Waste Characteristics Product, subject to a maximum value of  $1 \times 10^6$  [1, pp. 51592, 51624].

Ecosystem Toxicity/Persistence Factor Value (10,000)  $\times$  Hazardous Waste Quantity Factor Value (100):  $1 \times 10^6$

The Waste Characteristics Product for the watershed (subject to a maximum value of  $1 \times 10^8$ ) is multiplied by the Bioaccumulation Potential Factor Value for benzo(a)anthracene and benzo(a)pyrene (50,000), to generate a second product, subject to a maximum value of  $1 \times 10^{12}$  [1, p. 51624].

(Ecosystem Toxicity/Persistence  $\times$  Hazardous Waste Quantity ( $1 \times 10^6$ ))  
 $\times$  Bioaccumulation Potential Factor Value (50,000):  $5 \times 10^{10}$

From HRS Table 2-7, the second Waste Characteristics Product ( $5 \times 10^{10}$ ) is assigned a Waste Characteristics Factor Category Value of 320 [1, pp. 51592, 51624].

=====

Hazardous Waste Quantity Factor Value: 100  
Waste Characteristics Factor Category Value: 320

#### 4.1.4.3 ENVIRONMENTAL THREAT - TARGETS

Sensitive environments have been identified along the hazardous substance migration pathway between the most upstream PPE along Sutton Brook and the most distant Level II surface water sample. The Commonwealth of Massachusetts has established surface water quality programs to support the objectives of the Federal Clean Water Act [77]. Surface water quality from the most upstream PPE of Sutton Brook to its confluence with the Shawsheen River in Wilmington, Massachusetts is designated as Class B [74]. Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation [73, p. 314 CMR-71]. The MA DEP Class B designation of Sutton Brook signifies designation for protection or maintenance of aquatic life [77].

Sensitive environments have been identified along the 14.36 miles of the hazardous substance migration pathway between the most distant surface water sample that documents Level II contamination and the 15-mile downstream target distance limit (see Figure 7 in Attachment A of this document) [60, pp. 1-4; 61-66]. Two State-designated Natural Areas are located along the banks of the Shawsheen River within the 15-mile downstream pathway, including Vale Reservation (approximately 3.5 miles downstream) and Shawsheen River Reservation (approximately 4.4 miles downstream) [97]. The Merrimack River is a migratory pathway and feeding area critical for maintenance of anadromous fish species (Atlantic salmon) [95, pp. 1, 2].

A number of wetlands are located downstream of the most distant surface water sample that documents Level II contamination along Sutton Brook and the Shawsheen and Merrimack Rivers upstream of the 15-mile downstream target distance limit [53; 60, pp. 1-4; 61-66]. Wetlands located along Sutton Brook from the most upstream PPE to the most distant observed release surface water sample are subject to Level II concentrations [60, pp. 1-4; 78, pp. 6-8; 79, pp. 6-9]. The remainder of the wetlands downstream of the site and upstream of the 15-mile surface water pathway terminus on the Merrimack River are subject to potential contamination [60, pp. 1-4].

Level II Concentrations

An observed release to surface water from the site is established by chemical analysis of surface water and sediment samples [78, pp. 6-8; 79, pp. 6-9; 113, pp. 7, 10, 11; 114, pp. 7, 10]. The most distant Level II sample, surface water sample designated SW-02, was collected from Sutton Brook approximately 0.64 miles downstream of the most upstream PPE to surface water [3, pp. 66, 67; 104, p. 2].

Sample ID: SW-02

Sample Medium: Surface water

Location: Sutton Brook

Reference: 3, pp. 66, 67; 79, pp. 6, 8

Hazardous Substance	Hazardous Substance Concentration
Arsenic	33.8 $\mu\text{g/L}$

Most Distant Level II Sample

An observed release to surface water from the site is established by chemical analysis of surface water and sediment samples [78, pp. 6-8; 79, pp. 6-9; 113, pp. 7, 10, 11; 114, pp. 7, 10]. The most distant Level II sample, surface water sample designated SW-02, was collected from Sutton Brook approximately 0.64 miles downstream of the most upstream PPE to surface water [3, pp. 66, 67; 78, pp. 6, 8; 79, pp. 6, 8; 104, p. 2].

Sample ID: SW-02

Distance from the probable point of entry: 0.64 miles

Reference: 3, pp. 66, 67; 76, pp. 4, 13; 78, pp. 6, 8; 79, pp. 6, 8; 104, p. 2

**4.1.4.3.1 Sensitive Environments**

Actual contamination sensitive environments have been identified along the hazardous substance migration pathway between the most upstream PPE along Sutton Brook and the most distant Level II surface water sample (SW-02).

**4.1.4.3.1.1 Level I Concentrations**

No Level I sensitive environments have been identified along the 15-mile downstream pathway.

**Sensitive Environments**

<b>Sensitive Environment</b>	<b>Distance from Probable Point of Entry to Nearest Point of Sensitive Environment</b>	<b>Sensitive Environment Value(s)</b>	<b>Reference</b>
NS			

Sum of Sensitive Environments Value: NS

**Wetlands**

<b>Wetland</b>	<b>Wetland Frontage</b>	<b>Reference</b>
NS		

Total Wetland Frontage:  
Wetland Value:

Sum of Sensitive Environments Value + Wetland Value:

=====  
Level I Concentrations Factor Value: NS

4.1.4.3.1.2. Level II Concentrations

The Commonwealth of Massachusetts has established surface water quality programs to support the objectives of the Federal Clean Water Act [77]. Surface water quality from the most upstream PPE of Sutton Brook to its confluence with the Shawsheen River in Wilmington, Massachusetts is designated as Class B [74]. Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation [73, p. 314 CMR-71]. The MA DEP Class B designation of Sutton Brook signifies designation for protection or maintenance of aquatic life [77].

Sensitive Environments

<b>Sensitive Environment</b>	<b>Distance from Probable Point of Entry to Nearest Point of Sensitive Environment</b>	<b>Sensitive Environment Value(s)</b>	<b>Reference</b>
State designated area for the protection or maintenance of aquatic life	0 feet	5	1, p. 51624, Table 4-23; 74; 77

Sum of Sensitive Environments Value: 5

Wetlands

<b>Wetland</b>	<b>Wetland Frontage</b>	<b>Reference</b>
Sutton Brook wetlands	1.2 miles	60, pp. 1-4

Total Wetland Frontage: 1.2 miles  
Wetland Value: 50

Sum of Sensitive Environments Value + Wetland Value: 55

=====

Level II Concentrations Factor Value: 55

4.1.4.3.1.3 Potential ContaminationSensitive Environments

Sensitive environments have been identified along the 14.36 miles of the hazardous substance migration pathway between the most distant surface water sample that documents Level II contamination and the 15-mile downstream target distance limit. Two State-designated Natural Areas are located along the banks of the Shawsheen River within the 15-mile downstream pathway, including Vale Reservation (approximately 3.5 miles downstream) and Shawsheen River Reservation (approximately 4.4 miles downstream) [97]. The Merrimack River is a migratory pathway and feeding area critical for maintenance of anadromous fish species (Atlantic salmon) [95, pp. 1, 2].

<b>Type of Surface Water Body</b>	<b>Sensitive Environment</b>	<b>Sensitive Environment Value(s)</b>	<b>Reference</b>
Moderate to large stream	State designated Natural Area	25	1, p. 51624, Table 4-23; 97
Moderate to large stream	State designated Natural Area	25	1, p. 51624, Table 4-23; 97
Large stream to river	Migratory pathway and feeding area critical for maintenance of anadromous fish species within river reaches	75	1, p. 51624, Table 4-23; 95, pp. 1, 2

Wetlands

Approximately 12.0 miles of total wetland frontage exist from the most downstream surface water sample location that documents Level II actual contamination to the terminus of the 15-mile target distance limit [60, pp. 1-4].

Type of Surface Water Body	Wetlands Frontage	Wetlands Value for Type of Surface Water Body	Reference
Minimal stream	1.5 miles	50	1, p. 51625, Table 4-24; 60, pp. 1-4
Moderate to large stream	8.9 miles	250	1, p. 51625, Table 4-24; 60, pp. 1-4
Large stream to river	1.6 miles	50	1, p. 51625, Table 4-24; 60, pp. 1-4

Type of Surface Water Body	Sum of Sensitive Environment Values ( $S_j$ )	Wetland Frontage Value ( $W_j$ )	Dilution Weight ( $D_j$ )	$D_j \times (W_j + S_j)$
Minimal stream	0	50	1	50
Moderate to large stream	50	250	0.01	3.25
Large stream to river	75	50	0.001	0.125

Sum of  $D_j(W_j + S_j)$ : 53.375  
 (Sum of  $D_j(W_j + S_j)$ )/10: 5.3375 = 5  
 Reference: 1, p. 51625, Section 4.1.4.3.1.1

=====

Potential Contamination Factor Value: 5

#### **4.2 GROUND WATER TO SURFACE WATER MIGRATION COMPONENT**

Not scored.

**Attachment A**  
**Figures 1-8**

A copy of Figure 1 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office  
Crystal Gateway #1, 1st Floor  
1235 Jefferson Davis Highway  
Arlington, VA 22202

Telephone: (703) 603-8917  
E-Mail: [superfund.docket@epa.gov](mailto:superfund.docket@epa.gov)

A copy of Figure 2 is available at the EPA Headquarters Superfund Docket:

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A copy of Figure 3 is available at the EPA Headquarters Superfund Docket:

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A copy of Figure 4 is available at the EPA Headquarters Superfund Docket:

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A copy of Figure 5 is available at the EPA Headquarters Superfund Docket:

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A copy of Figure 6 is available at the EPA Headquarters Superfund Docket:

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A copy of Figure 7 is available at the EPA Headquarters Superfund Docket:

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A copy of Figure 8 is available at the EPA Headquarters Superfund Docket:

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